TECHNOLOGY

approach

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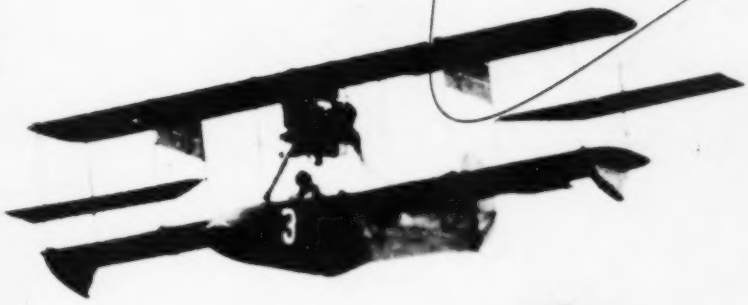
V6 # 11



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APPROACH
The Naval Aviation Safety Review

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On the Cover —

Year: 1916
Place: Pensacola Bay
Aircraft: Curtiss Flying Boat
From these early catapult experiments came the powerful cat shots required for high-performance jets of today.

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NUMBER 11

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Our Product is safety, our process is education, and our profit is measured in the preservation of lives and equipment.

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LETTERS

Safety Program Pays Off

Sir:

The Aviation Safety Program at NAS Alameda is proving astonishingly effective if—as the politicians say—you "look at the record." While the 1960 Navy-wide aircraft accident rate was 1.5 accidents per 10,000 flying hours, the rate at Alameda was but .68.

According to Alameda's Safety Officer, R. M. Reynolds, the other safety statistics on the station are equally as impressive.

Here at the Navy's largest overhaul and repair department for aircraft, 1958 saw the towing of airplanes produce 12 accidents costing over $2000—while 1959 saw the figures diminish until 1960 produced but five towing accidents costing $193.

The newly established Alameda Aviation Safety Program provides for incentives, recognition, commendations, and extra privileges for safety-minded station personnel.

SIO

● **Good work—keep it up.**

Qualified?

Sir:

One of the 50-gal. trailers was found tonight with all valves closed, and 95 lbs. registering on the gages. It was used last by a "splinter" group—and was found parked under the "protective" shelter of an A3D. The "unqualified" user was a standby who was actually standing by to go ashore. I trustingly hope others in the fleet have the word on what a "qualified" man means—.

GSE TYPE

Cubi Point

Approach Distribution

Sir:

Regarding your inquiry concerning the distribution of APPROACH, in VP-8 copies of APPROACH are placed in magazine racks in all of the heads, the crew's readyroom, and on a clipboard in the wardroom. Other copies are routed through each department's routing system. About three days after the magazine arrives in the squadron, the only copies to be found are those "nailed" down on a clipboard or in routing. I doubt that each copy reaches 12 intended readers—the fact that each individual wants his private copy is probably a tribute to the quality of APPROACH. It's as welcome as an unclaimed wrench set in the hangar shops.

As Aviation Safety Officer, I corner one copy of each issue and file it in a binder in the readyroom bookcase where I use it for a lecture reference and where the standby pilots are occasionally caught browsing among the old issues (with still-good dope!).

I would welcome any ideas on how to control the dissemination of APPROACH.

DEAN R. JOHNSON, LCDR
Patrol Squadron EIGHT

Sir:

This squadron receives 30 copies of APPROACH. This number provides one copy for each 11 persons on board.

The number received is slightly excessive by the 12 for one criteria but is considered desirable in order to allow for a routing copy, a library copy and one or two working copies (copies held by individuals for lecture material and/or extraction of articles for the squadron newspaper and cross reference files.)

Distribution of APPROACH is as follows: 1—Routing, 1—Safety Library, 1—Working Copy, 3—Readyroom, 17—Maintenance, 4—Operations, 3—CPO Readyroom.

W. A. HELTON
ASO, VP-56

Sir:

TRARON ONE and Saufley Field ASO's operate from a joint office which controls distribution of all safety material including APPROACH.

From experience, need-to-know and requests, a spread sheet has been compiled that the safety yeoman uses in routing. From the time the publications arrive on board until distribution is completed is always less than two working days using twice a day yard mail runs.

Routing by Commands follows: copies in parentheses.

Saufley Field:

C.O. (1), X.O. (1), Ops (1), Tower (1), Flight Clearance (1), Crash Crew (1), Personnel (1), I and E (1), Security (1), Supply (1), Industrial Safety (1), S.I.O. (1), Chaplain (1), Flight Surgeon (1), Maintenance (5), Para Loft (1), BOQ (3), BOQ Annex (2), Cadet Battalion (3), Safety (2).

TRARON:

C.O./X.O. (1), Training (1), Ops/Stan (1), Inst. Training Section (1), Academic Training (1), Instructor's Ready Room (3), Maintenance (6), Line Ops (3), Tech Reps (1), Flight Units (16—4 to each), First LT (1), "Headwork" folders (13).

In all, we receive 100 copies of

APPROACH welcomes letters from its readers. All letters should be signed though names will be withheld on request. Address: APPROACH Editor, U. S. Naval Aviation Safety Center, NAS Norfolk, Va. Views expressed are those of the writers and do not imply endorsement by the U. S. Naval Aviation Safety Center.

APPROACH for 550 pilots and 900 crewmen.

. . . How about sending us some ANYMOUSE forms. We just can't seem to keep our boxes stocked. Ninety-five percent of them disappear or are used for scratch paper, it seems. But we have to put them out or the 5 percent won't be available for those who want them.

RON KENNEDY, LT
ASO

Sir:

This squadron receives 24 copies which are sent directly to the Aviation Safety Officer, when the squadron is home based at NAS, Quonset Point, or to a designated routing yeoman, when the squadron is deployed to the Antarctic, for further routing.

The Aviation Safety Officer routes one copy to the C.O., X.O., Admin Officer, Maint Officer and Ops Officer. This copy is returned and filed in the Aviation Safety file. Additional copies are routed as follows: Commanding Officer/Executive Officer, Administration, Personnel, I & E, PRO, Maintenance, Quality Control, Operations, Training, Flight Safety Board, Navigation, Communications, Photography, Supply, Squadron Duty Officer, Survival, Leading Chief, Flight Surgeon, and the Maintenance areas of Line, Air Frames, Power Plants and Avionics.

When the squadron is deployed to NAF McMurdo Sound, Antarctica with detachments at NAS Quonset Point, Christchurch, New Zealand, and Byrd Station, Antarctica, the yeoman routes one copy to the Commanding Officer, Executive Officer. This copy is returned and filed in the Aviation Safety file. Copies are routed as follows: C.O., X.O., Admin., Christchurch, Admin., McMurdo, Pers. Christchurch, PRO, 2 each to Maint., Christchurch, Maint., McMurdo, Ops Christchurch, and to Ops McMurdo, Safety, Flight Surgeon, Survival, 4 copies to Byrd Station, Supply Christchurch and Supply McMurdo. Additional copies sent to Quality Control at McMurdo, are routed to the shops and line areas.

Pertinent APPROACH articles are mentioned in APMs at Quonset and in a Safety information sheet that is disseminated to all pilots when the squadron is deployed.

W. H. MUNSON

'Count Down!'

Sir:

At a recent meeting of the Phoenix Air Traffic Control Advisory Committee a subject came up which is considered worth an article in APPROACH. The subject is the continued violation of restricted areas by military as well as civilian, including airline, pilots.

An example: recently in the vicinity of Fort Bragg count down was commenced for the firing of a heat-seeking missile at a drone scheduled to fly well within the boundaries of a well defined and well advertised restricted area. At the minus 2 second warning the firing was aborted due to a four-motor transport, believed to be military, blithely proceeding through the middle of the area. Had not the man in the radar scope been extremely alert, a tragedy could have resulted.

M. R. BUSH, LCDR
Operations Officer
U.S. NAF Litchfield Park

Chopper Assist in Rescue

Sir:

An AF H-43B helicopter has played a major role in the rescue of eight crew-members of a B-52 bomber which crashed and burned at Larson AFB, Washington following an in-flight refueling mishap, December 15, 1960.

According to news reports, the right wing of the B-52 was damaged when it contacted the refueling boom of a KC-135 jet tanker. Following the incident the bomber returned to Larson AFB and was making what appeared to be a normal emergency landing when the right wing hit the ground.

During the ensuing crash an explosion occurred and the aircraft caught fire. Because there had been ample warning of trouble, the H-43B and all ground vehicles were on the scene. Hovering near the aircraft, the helicopter used its rotor downwash to assist ground rescuers in reaching the aircraft. A second explosion blew the helicopter away from the scene. Undamaged, the helicopter returned and kept a large quantity of fuel from igniting until all crewmen had been evacuated from the bomber. There were 128,000 pounds of fuel aboard the downed bomber.

All eight bomber crewmen survived the crash. The bomber's tail gunner suffered the most serious injuries but was not critically hurt.

—AHS

No Need to Speed

Sir:

I find the following reminder to my Ground Equipment drivers quite effective:

> "Those that are speeding—
> are driving a vehicle needing
> washing and waxing—
> by the driver."

One hitch—this works so well all my gear needs washing.

O. G. KIGHT, ENS
Ground Support Officer

Navy 520, FPO
San Francisco

3-D Approach Charts

Sir:

Members of our Association have been reviewing current chart presentations of terminal areas and studying methods of improving the readability, clearness and simplicity of information contained on these charts. As you are no doubt aware, the presentation of all the necessary information in a clear readable manner for saturated high density areas on a chart small enough to provide ease of cockpit handling does present a problem.

One of our members, who is also a Naval Reserve Pilot, has advised us that the Safety Center has been evaluating a new type of approach chart with a 3-D effect which he considers to have much merit.

Our committee would appreciate very much a copy of this chart for study and possible ideas. Therefore, we would like to request a copy of this chart, if available, and any other charts or ideas you might have that would be helpful.

JACK G. HARRINGTON
Engineering & Air Safety Dept
Air Line Pilots Association

● **Copies of April 1960 APPROACH article "Approach in Perspective" and a few experimental perspective plates are on the way.**

Diaphragm Dope

Sir:

Here's some hot dope on a part that has been redesigned and whose stock number/part number isn't in the catalog. The part is a new diaphragm for Pressure Regulator XAM-077 (Linde Air Products) Air Nitrogen Servicing Trailer (Type NAN-1, 515R100 Szekely). The new part no. is 30413 and re-

Transferring?

If you've transferred recently, or moved locally, and have a personal subscription to APPROACH, please send your change of address to Supt. of Documents, Government Printing Office, Washington 25, D.C.

places part no. 130Z08, (item 17, page 24 of NavAer 19-25B-511 of 1 May 1959). Two are required per trailer; cost $6.60 each. The part developed by the Air Force and Linde Company—Division of Union Carbide Corporation is currently available from the New York Office of Linde Co.

R. C. BALL, LCDR
Aircraft Maint. Officer

NAS Glenview

Switch Guards

Sir:

Re APPROACH, February 1961, page 28, concerning the "Fumble Fist" incident involving inadvertent dumping of fuel from an A4D-2 tanker. BuWep Accessories Bul. No. 9-60 of 3 October 1960 covers installation of spring loaded switch guards on the DUMP position of the ON-OFF-DUMP switch and on the HOSE JETTISON switch of the Model D-704 air refueling store control console.

ALLAN M. McKENZIE
BuWeps RAAE-331

Lens a Hand

Sir:

One night the airframes mechanics in our squadron were on the flight deck working on a hydraulic leak. The red fluid was impossible to see with red-lensed flashlight so a white light was used.

Word from the OOD to put out the white light stopped maintenance progress until the two AMs got their heads together. The junior man, naturally, came up with the equipment to do the job — The solution was so simple they were surprised no one had thought of it before. Use a green lens — red hydraulic fluid then appears black.

ANYMOUSE MECHS
VA-23

● Thanks for the tip—hope others read and heed.

Navigation Variation

Sir:

A problem which has recently been noted in this squadron concerns navigational errors which can lead to flight violations when flying airways in jets because of failure to take variation into consideration.

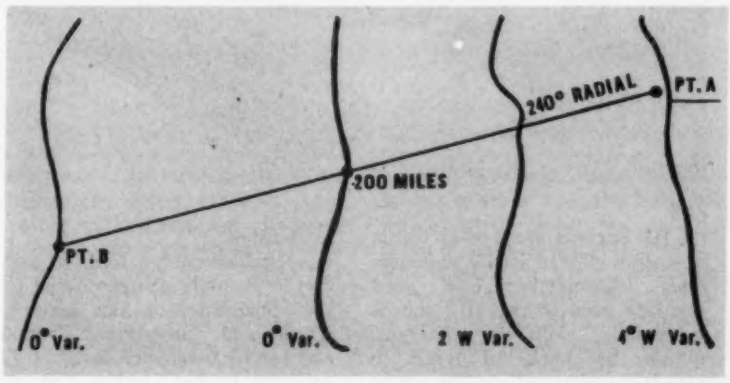
This problem is offered to convince the doubting Thomases:

You depart Pt. A on tacan on the 240° radial. Destination is Pt. B. At 200 miles you are still on the 240° radial. What is your actual position? If you tune in Pt. B what will it show on bearing? (Answer below)

Of course on the high altitude chart there are precomputed routes. Note that the variation lines don't stick out prominently. These will usually be correct, but notice how often the direction changes between points. If you draw a line yourself between two points, you'd better take old demon variation into account. I have not done so in the past, but from now on I will. This little gem caused a violation to be filed on one of our pilots.

For another example, check the course from Seymour Johnson AFB, N. C. to Macon, Ga. Both have tacan and there is no tacan station in between. You stay on SJ tacan for about 225 miles, will you clear P-378?

CARL A. BROWN, CDR
Chief of Staff, CVG-4



● Variation is west — compass is best; so the 240° radial is 236°T since tacan is orientated for magnetic bearings at the station. Therefore at 200 miles (0° variation) the line from station A will be 4 degrees (measuring from Pt. A) south of the dot on the map.

If Pt. B is tuned in it will show the pilot to be south of his course, e.g., on the 065° radial of the Pt. B tacan.

Fuel Truck Painting

Sir:

What ever happened to the proposals that JP fuel trucks and loading stands be painted barberpole striping with fluorscent red-orange paint — and the other suggestions in the interest of more positive refueling procedures?

GAS HOUSE MOUSE

● At the moment the Aviation Technical Services Committee Institute of the American Petroleum Institute is considering a standard color code in distinguishing different grades of fuel.

Pending the recommendation from this committee it is not considered desirable to authorize a special color for jet fuels at this time.

However, the benefits that may be achieved from your proposals, especially the use of reflectorized markings, are recognized and will be considered when the standard color code is accepted.

Meanwhile, BuWeps welcomes any and all suggestions for improving the aircraft fuel delivery/refueling/reoiling procedures. These suggestions will be given careful consideration for incorporation into the Aviation Fuel Operation Handbook currently under development. ●

Remember how much fun flyi

THE current spate of nicotinic nostalgia offered in TV commercials ("Remember how good cigarets *used* to taste?") moves us to note briefly the recurrent, similar flashbacks in flying, in which we elder pilots are prone to indulge.

Such harkenings back to yesteryear usually are prompted by the appearance of new instructions and procedures which seem to be fiendishly designed to remove the last vestiges of enjoyment from the aviating business. Whereupon there is loud lament concerning the state of aviation nowadays, and considerable listener sympathy is aroused on hearing . . .

"Why, bub, when *I* was an en-

by CDR R.P. Brewer
Staff, Post Graduate School, Monterey, Calif.

ffng used to be?

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sign, fresh out of Pensacola . . . " and thereafter you're regaled with heart-stirring tales of how they used to leap into the blue—the near deserted blue it was then, unmarred by the flicker of anti-collision lights, uninhibited by the insidious influence of IFR and the prying eye of radar surveillance.

Then, the "famming" pilot of, say a F6F, might roam the high (2 to 10,000′) sky in search of new transports (NATS), questing the dimly defined air trails for kindred spirits, perchance to scissor them into satisfying two-turn spins over Old Smoky (Pittsburgh).

Or to stalk, gleefully, an unwary "wrappie" (Army Air Corps) citizen. Or, remember the high spirited antics that greeted you in your first squadron, when you swelled with pride to be invited along on a "freeze-out" tailchase under the Old Bridge—how the lowly earthbound peasants shrieked with awe, or something, as you buzzed down the highway—the beauty of the perfect man-machine team marred only occasionally by encounters with high tension wires. Yessiree, those were the days, ehh? None of your fancy dan flight planning for that hardy breed—"Gimme an Esso map and a city directory, buster, and I'll get you there!" A rolling takeoff, tuck up the Goodyears (or was it Firestones), and a neat roll before passing the end of the runway. "Meet me over the field."

Man, that was living. Now? Hah? Why even the carefree chatter of the past has been replaced by your stodgy, uninspired radio discipline. Remember the way we used to pull the hilarious "Who dat? Who dat say who dat?" routine that used to sizzle CAG when he was trying to rendezvous the group grope?

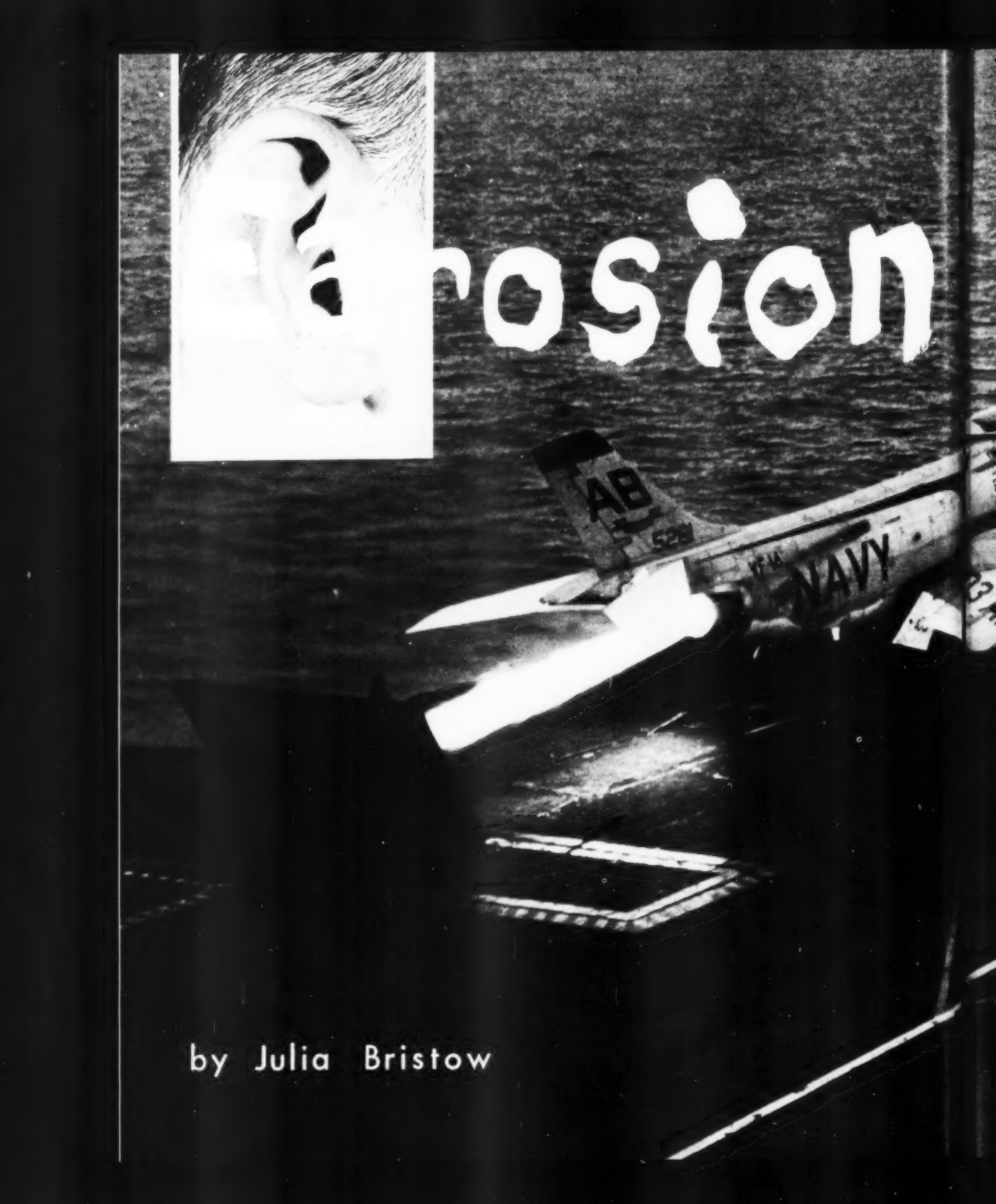
No sir, things just aren't the same. The sublime satisfaction of sneaking in under the overcast . . . "Cheeze! I got a hatful of pine cones outta my oil scoop!" They've taken the individuality out of the business . . . A good LSO could recognize every pilot by the peculiarities of his pass; all different—but no more. CCA and the mirror approach changed all that, along with the heady joy of the high speed break.

Navigation? Just get out and go, we did, into the chute-pinching thrill of a low-frequency range orientation, without a chart. Tacan and OMNI and radar and UHF do the job for you now, but then, no tiresome requirements of position reports and altitude assignments and nagging safety officers—Dilbert cartoons were good enough for us.

Yessir, they'll say, give me the plain, simple life, uncluttered with checkoff lists and Vg diagrams and FURs and computers and such. Shoulder straps? Who wants to fly in a straight jacket? Crash helmets? Sonny, we were a real hard-headed group, when the measure of a pilot was his ability to sideslip off a buggered-up overshoot; to horse a reluctant bird off the runway in jig time; to interpret a 200 mag drop as a transient bit of water, and let's get the show on the road!

Those were the days, indeed. It was a great life, the likes of which we'll never see again, those of us who are still around. And there were giants in those days too, who can still spin a wonderful yarn of a lusty era—yarns that glow more warmly with each passing year and each fond retelling. So, you youngsters, listen and learn—you can filter out a great deal of satisfying information. But there's one thing . . .

Just don't ask him what the accident rate was that year!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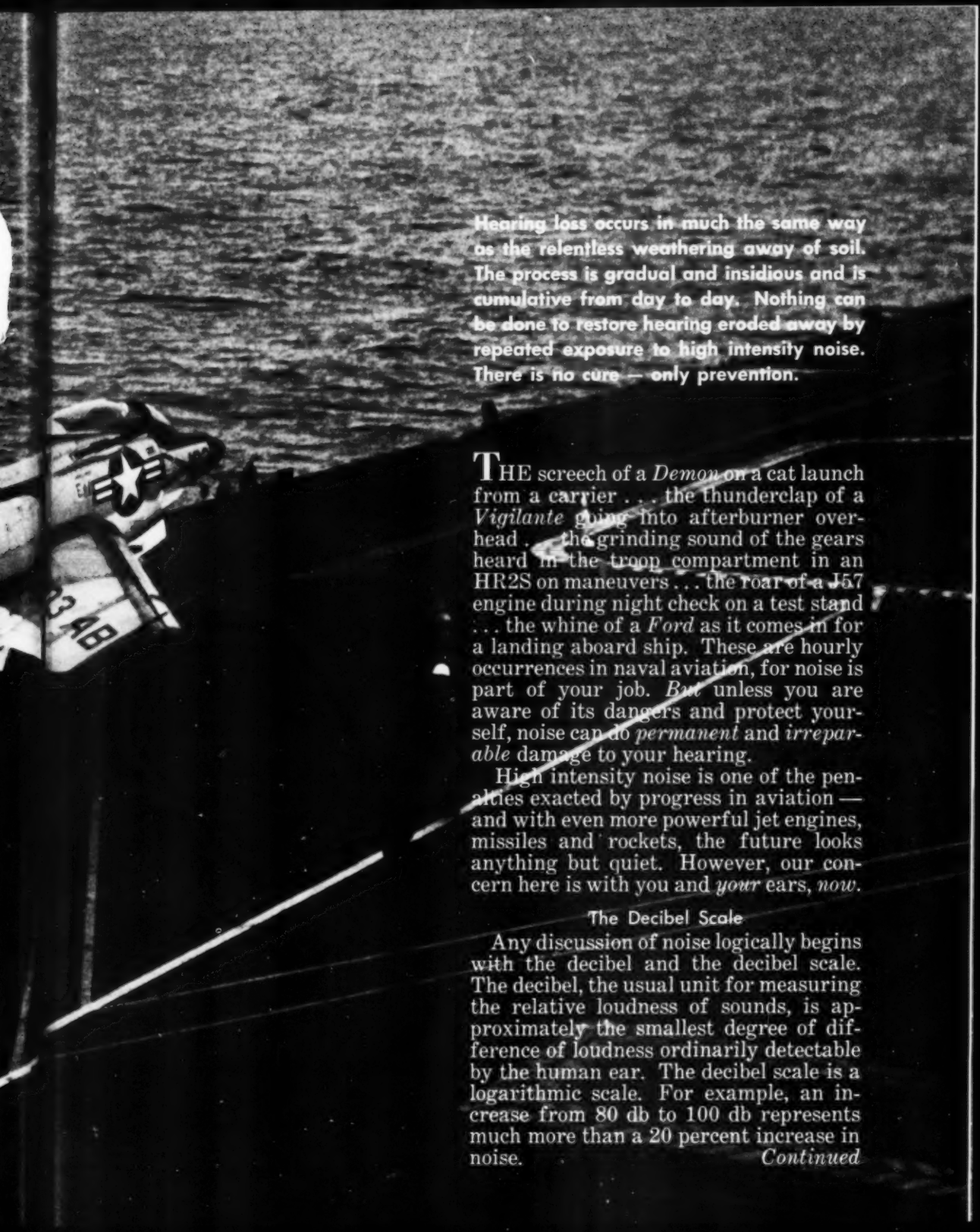
NAVY
by Julia Bristow



Hearing loss occurs in much the same way as the relentless weathering away of soil. The process is gradual and insidious and is cumulative from day to day. Nothing can be done to restore hearing eroded away by repeated exposure to high intensity noise. There is no cure — only prevention.

THE screech of a *Demon* on a cat launch from a carrier . . . the thunderclap of a *Vigilante* going into afterburner overhead . . . the grinding sound of the gears heard in the troop compartment in an HR2S on maneuvers . . . the roar of a J57 engine during night check on a test stand . . . the whine of a *Ford* as it comes in for a landing aboard ship. These are hourly occurrences in naval aviation, for noise is part of your job. *But* unless you are aware of its dangers and protect yourself, noise can do *permanent* and *irreparable* damage to your hearing.

High intensity noise is one of the penalties exacted by progress in aviation — and with even more powerful jet engines, missiles and rockets, the future looks anything but quiet. However, our concern here is with you and *your* ears, *now*.

The Decibel Scale

Any discussion of noise logically begins with the decibel and the decibel scale. The decibel, the usual unit for measuring the relative loudness of sounds, is approximately the smallest degree of difference of loudness ordinarily detectable by the human ear. The decibel scale is a logarithmic scale. For example, an increase from 80 db to 100 db represents much more than a 20 percent increase in noise.

Continued

The following chart of selected sound intensities is from Armstrong's *Principles and Practice of Aviation Medicine:*

Energy Units	Decibels	Examples
10,000,000,000,000	130	Airplane noise—pilot's head out in slipstream (threshold of painful sound)
1,000,000,000,000	120	Artillery gunfire
100,000,000,000	110	Airplane noise—open cockpit
10,000,000,000	100	Airplane noise—closed cockpit
1,000,000,000	90	Auto horn
100,000,000	80	Airplane noise—sound proofed cabin
10,000,000	70	Stenographic room
1,000,000	60	Airplane noise—ultra-modern sound proofed cabin
100,000	50	Ordinary conversation
10,000	40	Average residence
1,000	30	Slight rustling of leaves
100	20	Whisper
10	10	One's own heart beat
1	0	Absolute stillness

A sound intensity up to 85 db has been generally thought to be the maximum "safe" level in areas of continuous occupancy. This coincides with conditions that exist when it is difficult to hear a loud spoken voice at a distance of one foot. From 85 db up to 95 db, BuMed Instruction 6260.6A "recommends" a hearing conservation program. Where noise sound pressure levels reach 95 db, the Instruction states "hearing conservation programs should be mandatory."

Noise as low as 90 db has been shown to affect auditory acuity. Sound intensities of 120 db are commonly regarded as those which first arouse definite discomfort. Noise of 130 db is considered to be the threshold for a tickle sensation, 140 db the threshold of noise which creates a true pain. Here, however the discussion becomes purely academic from the aviation worker's standpoint. By the time a noise is loud enough to cause pain in your ear, hearing loss is already on its way.

Damage Occurs in the Inner Ear

Damage to the hearing mechanism that results from noise exposure occurs in the inner ear. This is why nothing can be done to restore the hearing loss once it has occurred. The energy from the noise actually destroys the small nerve endings which send electrical impulses to the brain. Apparently, the nature of this destruction is identical to the destruction of the nerve endings in the inner ear due to advancing age.

Individuals vary in their susceptibility to noise and their ability to recover from it. For particularly susceptible persons, hearing loss from high intensity noise is not only insidious but cumulative from day to day. In noisy work areas, there is insufficient time between exposures for recovery by individuals who require a long time for the process.

Unless they are removed from the job or are provided with adequate protection before the impairment has reached a certain point, their ears do not recover appreciably even with long time allowances and their hearing losses may then be termed permanent.

At the present time, little is known about the non-auditory effects of noise. These appear in an intensity range in which medical experience is of necessity limited; the noise levels at which non-auditory effects begin to occur unmistakably are well above those known to be damaging to hearing.

Side Effect of Noise

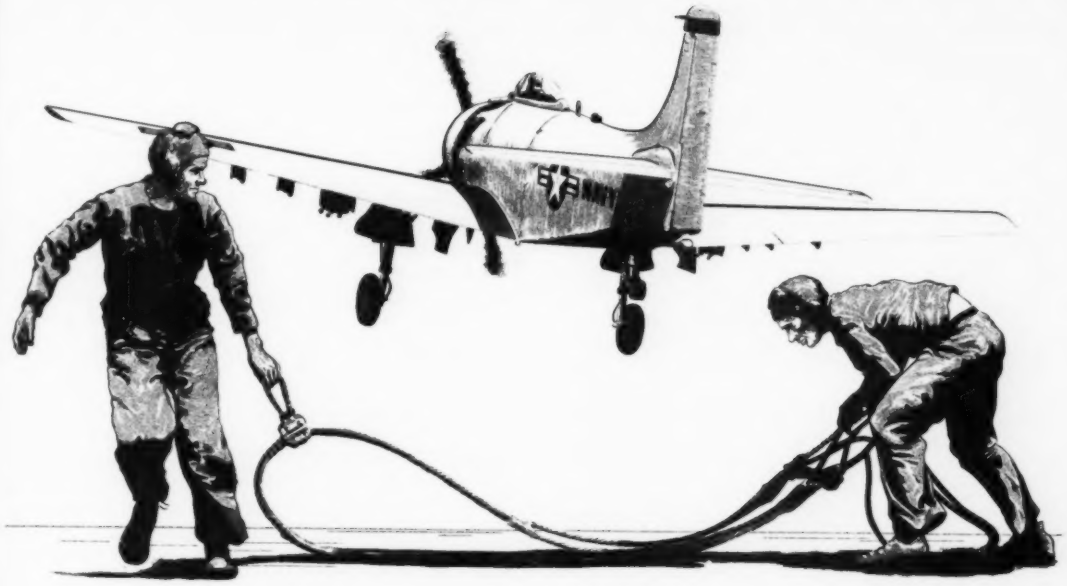
According to findings described by Armstrong, noise can affect the digestive system. "Observations on human beings by Smith and Laird at Colgate University," he writes, "have shown that a noise of 60 db or above inhibits the normal peristaltic activity of the stomach while a noise of from 80 to 90 db produces a decrease of 37 percent in the number of gastric contractions per minute. Laird also found that a noise intensity of 60 db or more reduces the flow of saliva by 44 percent and reduces the flow of gastric juices. From this it may be assumed that pilots are affected in like manner and if so, noise may be considered one of the etiological factors in the gastric disturbances which appear with such frequency in professional aviators."

Fatigue and Communications Difficulties

Generally speaking, pilots and crewmen, with the exception of those flying helicopters, have less of a noise problem than carrier flight deck and maintenance crews. However, all aviation personnel share the troubles of noise-induced fatigue and communications difficulties.

It appears likely that a portion of the pilot's fatigue can be attributed to the necessity for paying strict attention to the radio signals, especially during instrument flight. There is a psychological strain involved in the listening.

Conditions of intense static add to the pilot's and radio operator's noise problem. Static has a continuous noise spectrum, but its intensity varies rapidly with time and can be very great momentarily. Its average intensity is increased as the volume setting of the receiver set is raised to perceive the signal. At such times the signal must be higher than the ambient noise if adequate perception is to be maintained. The static plus the signal can then add very significantly to the total noise present.



Inside Noise Levels Vary

Actual noise levels measured in propeller-driven aircraft vary, depending upon both the type of airplane and the conditions of operation. All types are loudest during preflight checks, takeoff and climb. As engine power is reduced at altitude, the noise is lowered by as much as 10 to 15 db.

Noise levels in multi-engined aircraft vary considerably with crew position. In some aircraft it is the pilot who is exposed to the loudest portion as in sound-treated transport planes such as the R7V. In others it is the crewmembers who are stationed in the rear of the cockpit between the engines as in the P2V and in non-insulated transports. In P5Ms, for instance, the lookouts receive the brunt of the noise, both with jet APU on or off.

Noise Inside Jet Aircraft

Noise in jet aircraft in flight comes from two sources—the engines and the slipstream. The siren-like whine of the turbine wheel, an outstanding characteristic of the jet noise to listeners on the ground, is seldom perceptible within the cockpit. Because the principal part of the noise is generated outside the cockpit, the tightness of the cockpit and/or cabin seal together with the presence or absence of sound-attenuating material on the inside surface of the fuselage determines the noise level for a given airplane of any one model.

Helicopter Noise Levels

Anyone who has ridden in a helicopter will vouch for the statement that helicopter pilots, crewmen and passengers are subjected to ear-shattering noise. The condition is aggravated by the fact that during hot weather, especially, helicopters are flown with windows and doors open.

Two Navy flight surgeons, LT C. W. Metcalf, MC, USNR, and CAPT R. G. Witwer, MC, USN, made an extensive study of the noise problem in military helicopters. The following material is quoted from their account of their findings published in the Journal of Aviation Medicine in 1958.

"With the advent of the larger HR2S-1 type helicopter, this noise has become of high enough intensity to interfere with the passenger's hearing and to cause other post-flight symptoms. The overall noise level of the passenger compartment has now risen from an annoying 114 db in the HRS-3 previously used as a troop carrier, to a potentially harmful level of 119 db in the HR2S-1. The use of this latter aircraft to land combat troops has raised the question of what and how much effect the noise level has on a man after a one to two-hour flight particularly as it affects his combat efficiency . . .

"Hearing tests were performed on 33 subjects before and after 167 flights in an H2RS-1 helicopter using various methods of protection against noise. Noise levels in the passenger compartment

averaged 119 db. With no ear protection or standard issue Marine combat helmet, 18 to 22 db hearing losses were found after flights with recovery to normal in from 26 to 32 hours. *Cotton plugs and rubber ear defenders gave almost complete protection against the hearing loss.* Symptoms following flights such as tinnitus,* headache, nausea and drowsiness in conjunction with hearing loss, may create a problem in combat efficiency but are adequately controlled by simple protection (cotton or ear defenders). Seat location and duration of flight beyond a half-hour had little additional effect on hearing loss."

The noise level in the troop/sonar compartment in the HUS/HSS helicopters is somewhat lower than previous helos due to sound-proofing, the overall level being 105 db.

Noise on Carrier Flight Deck

The noise of the carrier flight deck during launch and recovery of aircraft is a problem unique to naval aviation. With the advent of jet aircraft the Navy stepped up its research in this area.

Among the more recent projects were the tests, carried out by the Service Test Division of NATC during the carrier suitability trials of the F4H-1 aboard the INDEPENDENCE to determine the sound pressure levels (SPLs) to which flight deck personnel are exposed during its catapult launching (The noise levels of other aircraft operating from the carrier during the tests were also recorded.)

The authors of the test report point out that measurements do not necessarily represent the maximum SPL generated by the aircraft; recording equipment locations simulated the position of catapult and flight deck personnel who are closest to the airplane during cat operations. It was found that during military power launches of the F4H-1, personnel on the flight deck and in the catwalks adjacent to the plane are subjected to an SPL of 138 db for 10 to 15 seconds and, momentarily, to an SPL of 142 db as the plane is launched. During combat power launches of the F4H-1, these personnel are subjected to SPLs of 133 db for 8 to 10 seconds, 138 db for 6 to 8 seconds, and momentarily to SPLs of 152 db.

* A ringing, buzzing or roaring sound in the ear.

Physician's Responsibility to Prevent Noise Trauma

It is of the utmost importance that physicians responsible for the care of air and ground crews exercise constant attention to the problem of aircraft noise. There is no known treatment for this type of deafness once it has occurred and the only course open is prevention. The physician concerned should know the noise levels involved and if above 90 db should take positive action to see that protection is afforded and used.—*Armstrong, Principles & Practice of Aviation Medicine.*

Sound Pressure Level Measurements Taken at Port Cat

Taxiing and Positioning on Catapult

F4H-1	117 db
A3D-2	110 db
F8U-1	93 db
F4D-1	92 db
F11F-1	91 db
A4D-2	90 db

Launching Position—Port Catapult

	A4D-2	F4D-1	F8U-1	A3D-2	F4H-1
Military Power Turn-up	128 db	129 db	127 db	136 db	133 db
Momentary SPL During Launch	136 db	139 db	139 db	145 db	142 db
Combat Power Turn-up	—	—	134 db	—	138 db
Momentary SPL During Launch	—	—	148 db	—	152 db

Ground Maintenance Work Noisiest

Although flight crews of many aircraft still are exposed to high sound levels and flight deck personnel work in an extremely noisy environment, today it is the ground maintenance crews who face the greatest noise problem. Jets equipped with afterburners are an especially serious source of danger. With all jet aircraft, moreover, the time of exposure during maintenance tends to be fairly long compared with that on reciprocating engined aircraft.

The constancy of operations is a significant factor in an evaluation of the noise hazard whether the aircraft on a station are powered by reciprocating or by jet engines. On busy flight lines the operating aircraft, the auxiliary power units (which generate from 100 to 112 db) and a variety of other power-driven tools and vehicles combine to maintain the average ambient noise for all men in the area at a level well in excess of the 85 db which has been generally thought to be the maximum "safe" level in areas of continuous occupancy.

Aside from acoustic trauma, there are other noise-produced ill effects suffered by ground maintenance and test crews—increased irritability and fatigue and their result: decreased quality of work performance. The difficulty of concentration and the desire for the noise to cease are thought to combine so that work is performed hurriedly and with less attention to accuracy. There is definitely a high potential for faulty maintenance, a potential which becomes greater as more powerful and more complex aircraft are developed.

In addition to fatigue, irritability and decreased quality of work performance, aircraft maintenance men in jet engine noise fields have experienced sensations of falling, nausea and vomiting.

No Such Thing as Ultrasonic Sickness

Medical authorities have discounted the existence of "ultrasonic sickness." On this point, McFarland states in *Human Factors in Air Transportation*, "From (various) experiments, it may be concluded that 'ultrasonic sickness' involving nausea, disturbances of equilibrium, mental confusion, and marked visual and motor disturbances, does not exist. Although it may be true that some abnormal symptoms are observed by men working near jet engines, they are caused not by ultrasonic but by intense sonic frequencies and by vibrations at relatively low frequencies."

Armstrong in his *Principles and Practice of Aviation Medicine* says that some of the effects of higher sound intensities other than those to hearing are purely psychologic.

Basic Approaches to Noise Problem

There are three basic approaches to the aviation noise problem:

- Aircraft can be made quieter by engine design.
- Exhaust-nozzle modifications or other devices that cause less noise to be generated can be added to the engine.
- Personal protective devices, which act as a block between the individual and the source of the noise, can be provided men working in high intensity noise fields.

Discussion of aircraft engine design and exhaust-nozzle modification is beyond the scope of this article. For readers interested in developments in the jet muffling device field, NASA Memorandum 3-5-59L, "Noise Problems Associ-

ated with Ground Operations of Jet Aircraft," by H. H. Hubbard contains a three-page bibliography of reports and papers on the subject.

From the standpoint of the man who worked today in the area of high intensity jet noise and who will do the same tomorrow, the third approach—personal protective devices—provides the most immediate and practical solution to the noise problem.

Ear Protection

There are at the present time, three general methods of occluding the ear with devices that attenuate airborne noise:

(1) *Insert types*—plugs inserted into the ear canal.
(2) *Cushion or doughnut types*—objects which cover at least the entrance to the ear canal and often the entire outer ear.
(3) *Helmet types*—fitted coverings for the major area of the head.

For adequate protection in some noise fields, a combination of these devices may be required—for example, near the tailpipe of any airplane equipped with afterburners when the latter are in operation.

Ear protective devices block out or attenuate noise of high frequency more effectively than noise of low frequency and are relatively more effective in attenuating the noise of jet engines than of reciprocating engines.

Some persons cannot wear standard insert type ear plugs because of the unusual size or shape of their ear canals or because of ear infections. These individuals must rely on over-the-ear type devices for sound protection.

Over-the-ear type protectors have advantages and disadvantages. In cold weather, they keep the ears warm but in hot weather they are uncomfortable and cause excessive perspiration. Frequently they are incompatible with personal equipment such as eyeglasses, parkas and hats.

The most common complaint against ear plugs is that they are uncomfortable. Proper fitting by a flight surgeon or hospital corpsman can overcome this problem to a large extent. An ear plug which is too small loses much of its value because even a slight leak greatly decreases the protection while one that is too large will be uncomfortable.

A popular misconception about ear protective devices in general and ear plugs in particular is that they interfere with hearing and understanding the spoken word. The opposite is true. *At any time when the ambient noise level exceeds 85 or 90 db, speech of a given intensity can be perceived more clearly through ear protective devices than without them.* Further, a louder signal can be used if desired and will be perceived without the distortion and discomfort so commonly experienced in very noisy situations. (Under conditions of extreme noise, however, signals cannot be distinguished with or without ear protective devices.)

Ear plugs are particularly effective under flight conditions. They serve to attenuate the ambient noise in the cockpit to a greater degree than can be accomplished by the action of the headset alone. They further act to improve the clarity of the radio signals.

The pilot's protective helmet affords much protection from sound conducted both through the middle ear and directly through the skull while the simple headset and/or ear plugs are effective only against sound conducted through the middle ear.

Research and development of new and improved ear protective devices continues. Study of the noise problem in military aviation continues. In the meantime, the best precaution against hearing damage is wearing ear protective devices every time you are exposed to high intensity noise. The best ear plugs and sound attenuating helmets in the world won't do you any good if they are back in your locker when you need them.

> Emphasis was placed on personnel practicing self-protection from the serious injuries that can result from jet engine noise. There are only two possible ways in which this problem can be beaten. One is to insure the best protective devices known to the men working near jet aircraft; the second, to institute an accelerated and continuing program of education for these men concerning the dangers they are exposed to around these aircraft and the best possible methods of protecting their health.—*3rd MAW, El Toro Safety Council Notes published* APPROACH *Nov. 1959*

Ear Protectors

Earcups, Polyurethane, Face Cushion, Leather Covered (Sizes: large, medium)

Standard Ear Plugs (V-51R)
Plugs, Ear, Noise Protection

Large 24S	FSN L6515-299-8288
Medium 24S	-8289
Small 24S	-8290

Navy Ear Muff
(Straightaway 400-9)

Helmets—Class 841S
—Flight Deck Sound Attenuating Helmet, Colored Cloth (various sizes and colors, includes interchangeable head band-ear cup) Type 273-9HA

(Allowance, Sec. 4, NavWeps 00-35QH-2, is six per assigned jet aircraft, four per AD type aircraft deployed aboard ship with jet aircraft.)

—Flight, sound type S/PH-1
(Sizes: small, medium and large)
Type D8-50A, B & C
(Allowance: 100% of pilot and 175% of non-pilot crew members of VS/HS Squadrons. VA(AW) Allowance: one per each ECM operator of assigned AD-5Q aircraft.)

—Inner Liner (for use with outer shell S/PH-1 type) (various sizes)
(Allowance: same as above)

—Headband: Stirrup and Dome Unit Assembly, Sound Attenuating
(Allowance: one per each passenger seat for helicopters)

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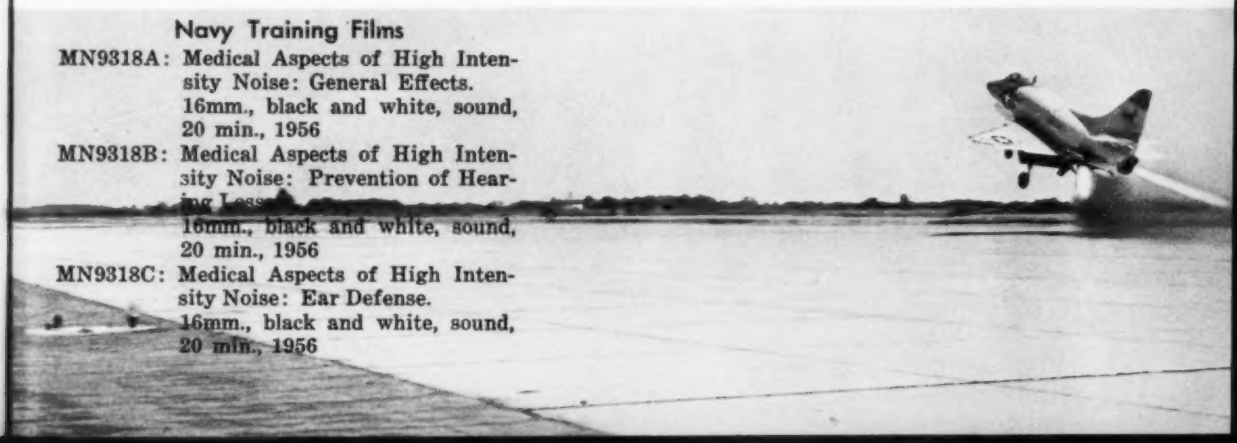
Navy Training Films

MN9318A: Medical Aspects of High Intensity Noise: General Effects.
16mm., black and white, sound, 20 min., 1956

MN9318B: Medical Aspects of High Intensity Noise: Prevention of Hearing Loss.
16mm., black and white, sound, 20 min., 1956

MN9318C: Medical Aspects of High Intensity Noise: Ear Defense.
16mm., black and white, sound, 20 min., 1956



COMPOUND EMERGENCY

With a damaged airplane, one obstacle would have been enough . . .

WING-DOWN landings in the F8U do not often happen but enough have been made to say that while they should be accomplished under ideal conditions, it is mostly a matter of extra speed on final followed by the field emergency arresting gear. But combine a wing-down condition with the first F8U wheels-up landing and the situation is sure to interest *Crusader* people.

This wing-down, wheels-up landing was set up by material failure and though the aircraft received overhaul damage, it must be considered a successful operation: There were no personnel injuries and the aircraft was at least in a condition to be overhauled. Let it be said immediately however, that the results do not constitute a blanket endorsement for trying the same thing. The squadron considered it a very dangerous situation and considered that ejection would be preferable in similar circumstances.

Initial trouble began during a gunsight tracking exercise as a flight of *Crusaders* were on their way home from an advanced tactics flight. While in inverted flight at zero-G, 300 knots, at 25,000 feet, the pilot heard a loud thump and began having some control problems. The port center section landing droop was turned down and back a full 140 degrees from its normal position and the inboard edge had entered the fuselage skin. At the same time the pilot noticed the low hydraulic pressure warning light came ON with a lack of utility system hydraulic pressure.

"Because I had to crane my neck so far around to see the droop," he said, "I mistakenly thought I was looking at the tail, not the wing. This tail for wing misconception I carried till after the landing.

"The two other aircraft joined on me, confirmed the damage, and I tried slow-flight down to 160 knots indicated airspeed and was able to maintain control but used much nose up elevator."

During this slow flight check the aircraft was in a clean configuration. An attempt to raise the wing normally was unsuccessful and then after considering the problem, the flight leader advised the pilot to leave his wing DOWN. The inboard edge of the port droop had smashed into the fuselage and he feared that raising the wing would only damage the aircraft further or possibly open the fuel cell.

At the time there was never any doubt that the wheels would not lower and it was felt that the only aerodynamic effect with lowered wheels would be an increase in drag. Consequently no attempt was made to check slow

flight characteristics with gear down and radio discussions between aircraft and base radio concerned only a wing-down landing.

A straight-in to a runway which would keep the aircraft clear of populated areas was intended. "I would fly the airplane down to the runway at a safe airspeed for control above 160 knots," said the pilot, "then take my cut and hold off till out of flying speed, land, and use the abort gear if necessary. I put my hook down early and had it confirmed. Then we switched to tower frequency and requested the alternate runway, but the tower advised there would be a 15-minute delay to rig the abort gear on that runway."

A fuel state of about 1000 pounds made it necessary to plan on using the duty runway which already had abort gear rigged. "Not wanting to lower the wheels while banked up over populated areas because of the possibility of unexpected control problems," the pilot said, "I delayed initiation of the emergency wheels lowering procedure until shallowing my bank at the 45-degree position.

"I placed the gear handle DOWN, pushed it in, turned, and pulled to blow down the wheels. Nothing happened and the wheel indicators still indicated UP. After several more attempts to pull the handle further out I declared my intention to land wheels-up. Realizing that strike damage from either ejection or belly landing was inevitable, I pulled again on the wheel handle. The tower confirmed that my wheels were still up and I continued the approach.

"End of runway was crossed at about 190 knots with a fuel state of 800 pounds. I estimate I contacted the runway at 170 knots in a flat approach and took a cut just before touchdown. The tail hit gently but the nose fell through harder."

The belly was sliding solidly on the runway at a point 2500 feet from the threshold and the F8U skidded 1500 feet on the runway, turning to the right and going off the side for several hundred feet of slide in the dirt. There was no fire. During this action the pilot shut off the engine master switch and saw that the aircraft was turning a little to the right. "I raised my arms to protect my head," he said, "fearing that the port wing would dig in. However the aircraft straightened out and came to a halt upright. I discovered the engine idling and shut down with the throttle then departed the cockpit."

Damage from the gear-up landing included a series of compression buckles at stations 198, 260, and 473. The underside was badly eroded back to station 555 and lightly eroded from station 555 aft to the extreme end of the tail cone which was badly eroded. Much of the lower internal structure was either buckled, eroded or cracked. Both wingtips contacted the runway during the slide and outer panels required replacement.

Previous to the accident the pilot had been instructed to raise the wing, then lower the landing gear upon experiencing utility system failure. This sequence was used to slow the aircraft for emergency extension of the nose wheel. Squadron doctrine subsequently reversed the sequence, wheels first, wing second, due to the following point.

If the break causing the utility failure is at a point common to both hydraulic and pneumatic system, as was the case in this accident, the integrity of the emergency system is destroyed and the *most* important item in determining whether to abandon or attempt to land the aircraft, that of lowering the wheels, cannot be accomplished.

At the time of in-flight damage the pilot initiated action to lower the droop and raise the wing pneumatically when utility hydraulic pressure vanished. The emergency droop and incidence guard was raised but the incidence handle was not pushed forward to release the droop Kidde valves. Subsequently he attempted unsuccessfully to bring the handle aft to raise the wing hydraulically. It was probably at this time, the accident board felt, that the pilot inadvertently moved the incidence handle sufficiently forward to trip the cruise droop Kidde valve. The movement required is slight and the handle was found in this position after landing. The cruise droop and landing gear use a common source of air supply for emergency lowering and opening the cruise droop Kidde valve allowed all air from the 900 cubic inch air bottle to escape through severed cruise droop lines.

Soliciting the views of a pilot who has been through something like this is about like asking for comments from a man who has just gone over Niagara Falls in a barrel. You get the impression that "once is enough!" Here is how the pilot summed up his experience: "In retrospect, it is obvious that whenever the remotest possibility of not being able to lower the landing gear exists, this should be attempted as soon as practicable, consistent with other conditions (fuel to get to a field with gear down), since without landing gear the aircraft is virtually certain to be a strike and other failures become unimportant."

A man can no longer cope with a hazardous situation in an intelligent manner when he is seized by . . .

AFTER giving his leg straps a hard tug, the student pilot pulled the face curtain and ejected from the disabled F11F. The parachute opened . . . he managed to get into the sling. Reaching down to unhook his leg straps, he found he had pulled them too tight—in fact he was still trying to unhook them when he hit the water.

As he hit the water he couldn't breathe, so he tore his helmet and oxygen mask off and threw them away. The billowing parachute rapidly dragged him along under the water. With all his might he tried to get his leg straps unhooked. About to strangle from swallowing so much water, he was ready to give up the struggle.

Suddenly, he remembered his survival knife, took it from its sheath on his right thigh and reached up and cut the shroud lines. The parachute canopy collapsed. Inflating his life vest helped the situation some but his feet were still tangled in the parachute lines and the parachute was still a heavy weight dragging on him. He cut the life raft lanyard and when he was unable to get the pararaft out of the container, he cut the raft out, luckily without damaging it. Inflating the raft, he climbed in, his feet still bound together with parachute shroudlines. After cutting his feet loose, he began to get sick and vomited until "there was nothing left." An hour and a half later, a search plane came overhead. He fired a flare and shortly afterward was rescued by helicopter.

"When the emergency occurred, I felt calm," he stated later. "After ejection I still felt calm enough to think I had everything under control. After hitting the water I was dragged by the parachute and this was the first time I felt panic."

How many times have you heard somebody say "He hit the panic button" or "If you can keep your head when all about you are losing theirs, you just don't have the big picture!"? But what panic can do to you in a survival situation is no laughing matter. Water survival or escape from the cockpit of a ditched or burning aircraft leaves no room for error. Panic can be quickly fatal. And even on land in an extended survival situation where time is not so much against you, panic can still cause you to make a fatal mistake.

Fear triggers panic but panic

does not have to inevitably follow fear.

"It is particularly true that situations that are filled with intense personal danger are invariably accompanied by fear," the authors of "Survival in Water" write. "Fear is the body's way of providing an emergency response to an unusual or unexpected stress. It stimulates the individual physically and mentally for the purpose of better preparing him to cope successfully with the danger that confronts him. However, depending on the make-up of the individual, his early background, training and experience, and the training he has had in the job he is doing, he is able to accept the fear and all of the discomforts which go with it or he is panic-stricken by anxiety and is rendered ineffective.

"Familiarity, experience and training act as buffers and protect the individual from a disorganizing psychological response . . . A *trained* and seasoned man has greater flexibility and is able to bend with the stress, so to speak, without breaking. Conversely, unfamiliarity, inexperience, and a poor quality of training or too little training are major causes of abnormal mental and emotional reactions."

If you know what may happen to you and are prepared you are less apt to panic.

A group of the country's leading psychologists, writing for the Armed Forces in World War II, stated, "Knowledge of the situation lessens fear. The unfamiliar is always more fearful than the familiar. *Habit makes fear less effective.* Fear is disorganizing—it makes men less alert, takes their attention from important matters, causes them to act for inadequate reasons..."

The antidote for fear and panic is training, training, and more training.

Training can make the difference between life and death when a pilot or crewman parachutes down into the ocean or has to escape from the burning cockpit of a crashed plane. Training is equally important in survival on land.

"The greatest hazard in a survival situation is not wild animals, exposure or starvation. It is fear," the USAF Flight Surgeon's Manual states. "Fear destroys a man's ability to cope with other hazards in an intelligent manner. Individuals who make an emergency descent in a strange terrain suffer from what is sometimes called 'mental shock' which is characterized by fear of the unknown, confusion, indecision and inability to organize activity or to make a sensible plan of action. This syndrome lasts for varying periods; in those who are aware of the principles of survival the period is short. In others who are unprepared for emergency, fear and confusion are likely to jeopardize their prospects of survival and rescue. This is the fundamental principle to be emphasized in survival training: A man can survive in practically any climate or environment even though he has but a minimum of equipment if he makes proper use of that equipment and takes proper advantage of his surroundings." Thus training is the basic factor.

There are other lesser factors which can also contribute to keeping down fear and panic in a group survival situation, whether on land or at sea:

- *Leadership:*
  An essential quality of the good leader is imperturbability and undeviating stability. A leader's calm behavior lessens fear in others for both fear and self-possession are contagious.
- *Humor:*
  In trying times and tense moments, a laugh can be a lifesaver.
- *Companionship:*
  The sight of another man who does not seem to be panicky is reassuring. Roll calls also help by reminding men that they are not alone. For example, the Army artillery's "Call out your numbers loud and strong" reassures each man through the smoke of battle that the others are still in their places, doing their parts and that they want to know that he, too, is still there, that they are thinking of him. The same thing applies to groups of survivors in the water, especially in darkness.
- *Physical Fitness:*
  And in all survival situations, individual and group: good physical condition works against fear.

But by far the best weapon of all against panic is training . . .

HUMOR

COMPANIONSHIP

training in emergency procedures and survival equipment until your actions become routine and automatic. Provided the action is correct, "act first, think later" is not bad advice for a survival situation. To help you acquire correct reflex responses to emergencies the Navy provides flight simulators, ejection seat mockups, bailout trainers, Dilbert Dunkers and survival schools. Take advantage of them.

As one Navy flight surgeon told his pilots some time back, "The only way you will be able to survive an emergency is to have a tailor-made reaction for the situation pre-wired and planted in the dusty recesses of your skull, ready to transmit as soon as the button is pushed. If you don't have one, that button will activate another standby circuit which is very effective indeed. The name of the other circuit is PANIC." ●

PHYSICAL FITNESS

"THE pilot had recent training in over-water parachute harness drill. About 10 months ago he had drill in an actual pick-up by helicopter from water. This recent training played a great part in the smoothness of the ejection, descent, getting out of parachute harness, and pick-up by helicopter. There is no substitution for this type of training. It makes the difference between what can be an orderly routine survival episode and confused, chaotic, and perhaps fatal results following a normal ejection."—*from an MOR*

Preflight Pays Off

"PRIOR to boarding the aircraft for this flight I made a thorough check of my survival equipment," the copilot of an HSS-1 states. "In doing so I discovered that *both* CO_2 bottles had been removed from my life jacket. I immediately replaced them."

About an hour after takeoff, the aircraft had to be ditched some four miles from the Golden Gate.

One Moment of Let-Up

WHILE preflighting an aircraft on the hangar deck, a plane captain got the soles of his flight deck shoes wet with JP-5 spilled on the wing. After checking the oil level, he jumped from the top of the fuselage onto the forward edge of the wing. As his feet contacted the surface of the wing, they slipped out from under him and his momentum carried him over the leading edge of the wing. He landed on the deck on his back.

"This accident involves one of the basic tenets in accident prevention namely, a constant awareness and vigilance concerning the means by which such accidents occur," the report states. "This plane captain has had a fair amount of experience and was aware of the danger of slipping in fuel or oil, especially on aircraft surfaces, but one moment of let-up in precaution and attention resulted in this accident, injury, and loss in man-hours and could have produced serious injury. Repetition is boring but obviously there is a need for constant instructions and warnings of the dangers in all phases of aviation when attention is lacking."

Not That Cumbersome

A TF-1 with seven aboard made an arrested wheels-up landing on a foamed runway at NAS Jax when the landing gear would not extend. Although the approach was over the St. John's River, the pilot, copilot and crew removed their life vests prior to landing "to facilitate their exits from the aircraft after landing."

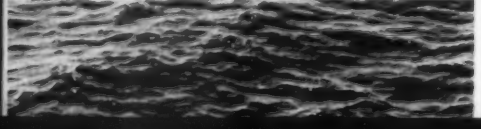
"In the situation of this accident," the reporting flight surgeon writes, "the removal of life vests while in a crippled aircraft flying over water, induces a potential hazard far outweighing any possible advantage of quicker exiting from the aircraft on the ground. The life vest is not that cumbersome."

PR-2 Life Raft

WHEN an HSS-1 had to be ditched four miles offshore, the copilot had difficulty inflating his PR-2 life raft. The pilot, who had had no trouble inflating his own raft, assisted him. The raft inflated only partially and had to be topped off orally.

Investigation indicated that the copilot's difficulties resulted from his pulling the toggle the wrong way. BACSEB 18-60 states, "The PR-2 packet raft is inflated by pulling the slide fastener tab down strongly. This disengages the slider completely from the case and actuates the CO_2 inflation valve, simultaneously. If the flotation tube requires frequent topping-off to maintain buoyancy," the BACSEB continues, "the oral inflation valve mouthpiece may be left unlocked. It is desirable, however, to lock the mouthpiece prior to automatic inflation in order to prevent an accidental loss of pressure."

notes from your FLIGHT SURGEON



Injury Prevented

AN F8U was engaged in aerial refueling from an A4D-2. The F8U pilot allowed the aerial refueling probe to move into the 9 o'clock position of the tanker drogue or "basket." The basket then collapsed due to the side load, whipped into the canopy and shattered the plexiglass. The pilot had the visor of his APH-5 helmet lowered. Although the visor did break and drop out of the helmet, it protected the pilot's face from injury.

Potential Danger

THE following comments were made by the reporting flight surgeon concerning a fatal accident involving a student aviator. The student made a "hot break" in the landing pattern, stalled the aircraft into an inverted position, attempted recovery in a split-S and crashed.

"This accident could very well have been prevented had someone, particularly fellow student pilots, reported Ensign _____'s potentially dangerous personality traits, specifically, his enthusiasm for the 'hot break.' Many of the students that were interviewed stated that they were not particularly surprised by the accident, since they had warned him of the dangers inherent in such a maneuver. However, they realized that he was not impressed by their warnings and they should have told someone such as a flight surgeon (or operations officer, safety officer, training officer or executive officer) so that steps could have been taken to further impress him with the serious consequences of such an act. Obviously, the main inhibiting factor was the avoidance of being a 'stool pigeon.' However, pilots must be mature enough to realize that this is not 'squealing' on a friend or fellow pilot, but that it is an attempt to save his (or someone else's life), and is in the best interests of everyone connected with aviation. The old quotation, 'An ounce of prevention is worth a pound of cure' is most applicable to this accident."

Shortsighted

THE pilot possessed both parts of the PSK-II survival kit but stated that he does not routinely carry them with him because they are "too bulky." Far too many pilots are now assuming the shortsighted attitude that nowadays rescue is always so rapid that carrying "excess gear" such as the PSK-II kit is not necessary . . . —*From an MOR*

NOISE QUIZ

1. Nothing can be done to restore hearing loss caused by damage to the hearing mechanism resulting from noise damage to the inner ear.
   T__ F__
2. Noise can affect the digestive system and cause increased irritability and fatigue.
   T__ F__
3. Ear protective devices block out noise of low frequency more effectively than high frequency. T__ F__
4. Ear protective devices do/do not interfere with hearing and understanding the spoken word. Do__ Do Not__
5. How should ear plugs be kept clean?

See page 48 for the correct answers.

ANYMOUSE

HAD-MOUSE

There's more to transient service than meets the plane.

A RECENT Air Force publication carried the following philosophy which interested me greatly.

"IT IS time for those responsible for support facilities to bear a fair share of the responsibility for accidents. When you hear that an aircraft is inbound to your base, whether or not it is transient, do something; and the lower the weather the faster you had better move."

This seems to have been written especially for a certain station which for the purposes of this account I shall call Bravo Base. The incident took place in winter, just a few days before official spring in 1960, but the background goes further back than that—to the summer of '58.

That year I had gone to Bravo Base with a squadron for a two-week deployment. One of my dirty duties was the early-early weather hop. During a morning when the weather was IFR a DD-175 was required and the weatherman filled the forecast section for ETA plus two with soup which was well below range minimums. Naturally I wrote "request GCA" in the remarks column.

One hour after takeoff I checked in with Approach Control and received clearance plus weather info. Arriving over the range at minimum altitude I was still in the soup and requested a GCA handoff. All I got by way of an answer was, "30-minute delay expected, advise intentions." I squeezed down another 200 feet, picked up the tower directly below me and completed a successful though illegal circling approach in 200 and 2 weather.

Since I did not particularly care for this, I chatted with the GCA officer. He asured me that there had been some mix-up and it would not happen again. Next morning the same weather pattern repeated itself; so did my request on the 175; so did all the ensuing events, including no GCA. There was not quite as much sweat as the ceiling was 400 feet.

I was pretty annoyed. After closing out I had a word with the Operations Officer and persuaded him to agree that it was not quite the way things were supposed to be. My efforts succeeded—up to a point.

On the third morning the weather pattern repeated itself once again and this time I got a GCA handoff. Only trouble was, the operators had apparently not calibrated their equipment recently. I rode an on-course to the ceiling (400 feet) but broke out a good 200 yards to the left of runway centerline. So even though I was successful in getting the crew into their trailer you might say I won only a Pyrrhic victory.

The story would have ended there except for a weekend trip I had to make north from home plate last year. Due to below-minimum weather the return trip had to be a roundabout route which called for stops at Alfa AFB, and Bravo Base. I landed at Alfa near midnight, had a bite to eat (food always available), then prepared to saddle up again.

Oops! Bravo Base was forecast for a 400 over and 1 mile in rain and fog. The spread was a gloomy one degree and the stability index was way over on the minus side (area was right on the boundary of a severe weather warning area).

Wait a minute. GCA at Bravo Base? Better check alternates real close. There was a doubtful (but legal) one within 150 miles. However the only sure port-in-a-storm was nearly 400 miles from Bravo Base and away from my desired course. While I could make the extra 400 miles with legal fuel reserves (I had an F9F-8B), I could not make a penetration at Bravo Base and have enough left to proceed to the No. 2 alternate, the sure thing.

The moment of truth would come at high station over Bravo Base.

I'm afraid you guessed what decision the old brain cranked out—Press on, regardless! But don't misjudge me. I decided to hedge my bets. The Clearance Officer was asked to call Flight Service Center and have them call Bravo Base to advise that I was now filing for there and (1) was GCA in commission, (2) would it be manned at my ETA? In a few minutes I got an affirmative on both questions. Satisfied, I passed the DD-175 over to the Clearance Officer.

The scene now shifts to a red-lighted cockpit, moving high and fast. Check points and fuel states were exactly as planned but abeam my No. 1 alternate I picked up the news that it was well below minimums with heavy rain. OK, so I still have No. 2.

Reporting over the last high-altitude airways fix before Bravo Base, I contacted Municipal Approach Control. They gave me weather but switched me to Bravo APC. A mistake; Bravo has insufficient personnel to man Approach Control from 2300 to 0800 so the Bravo tower operator had to call Municipal APC for my clearance. Meanwhile he had read me the same weather which I received from Center: 500 feet and 7 miles. I also received a GCA frequency and then got approach clearance. I began to think I had outsmarted the system.

What would you have done, remembering that once you descend below 20 thousand feet you are committed. There is not enough fuel to climb back and proceed to the No. 2 alternate. Like me, you would probably push over and start down.

Contact was made with GCA in penetration turn but at low station the operator informed me there would be a 15-minute delay because the GCA officer was not in the trailer. Well, right here I compounded the situation with an error. I got mad. I swore. Immediately I realized this was a serious mistake. The only result was to shake up the GCA operator so I tried to dispel his confusion. Asking as calmly as possible, I asked him what did he want me to do, hold, or continue the approach. This only made matters worse. It wasn't his decision and he knew it.

Somebody had to pick up the fumble so I made the decision to continue the run. The controller read me that 500 and 7 sequence again and I relaxed a little, confident that any significant change would have led the weather observer to put out a fresh report to his local people at least. Another mistake.

At 500 feet I looked ahead, then sideways, then down, then back at the gages because there wasn't anything else to see. At 200 feet there was still nothing to see, so I waved off. Then I got new weather. Big deal. Most of it I already guessed: It was indefinite 100 and ⅝ in rain and fog. I had taken the bait and was hooked, no chance now to make it to my carefully plotted alternate.

To keep everything legal I now declared an emergency, requesting my status be passed to Center and APC. To retain some command of the situation I announced that I would make the decision to land or not on the next two approaches. There was fuel for that many. Then I would follow a straight-ahead to flameout and ejection. Now came more fresh weather: Indefinite obscuration and ⅜. That's weasel-wording for the old zero-zero. Fortunately, arresting gear was available and I said I would shutdown on touchdown and coast into the gear—if I made it to the runway with the airplane still strapped on.

No. 2 approach was "on course, on glide path" down to about 400 feet. Then it was the same as before, a low to high with right drift. A new voice cut in and hurriedly gave me a "no-gyro" correction to on-course. This was the GCA officer. I brought it down to about 75 feet above field elevation on the gages then started looking. The starboard runway lights appeared over to the left (never saw the threshold lights) and I made a rapid left-and-right and planted it on the runway. My left tire was dribbling in the mud and hard right braking blew this one but I slewed back on to the asphalt, shut down, and caught the wire.

Well sir, I came out of that airplane looking for blood. I won't put it all down but after things cooled a bit, I found GCA is allowed a short period between the time an inbound aircraft reports for approach and the time the GCA unit must be ready to receive him. All the same it seems to be more important to be ready to go to work when needed. The aerographers in this case, who waited until the pressure was right on top of them before taking a belated special observation, I would blame for gross errors incompatible with personnel charged with support functions vital to recovering aircraft safely.

About the only person who functioned in the ground environment was the ODO who took the call from Flight Service, alerted GCA, Weather Service, Tower, and Crash Crew, and stayed up himself, waiting for me. The only other people who kept faith were the people in the crash crew. They at least were out in force and ready.

So much for my complaining side of the story. Let's look at the other side. I'll admit the ground people have some reason to be annoyed by an inbound at zero three in the morning. I'll even admit there was no pressing military necessity for me to be in the air at this uncivilized hour (had I pranged the bird, the board would have said get-home-itus). But let me ask an embarrassing question: Would the story have been any different if this had been a priority mission with some urgent military necessity? It's hard to see how there could have been any difference in the situation, and that sir is the whole point. The remedies are obvious.

TACAN

Tacan has been with us for some time now and is rapidly becoming the primary radio navigation system for USN and USAF aircraft. The first rosy flush of enthusiasm having died down a bit, perhaps it is time to examine the system more in detail — to find its strengths and weaknesses and how to make the most of them.

by MAJ. S.E. Adams, USMC

IN ORDER to understand tacan's good and bad points let's examine the operation of the system, some techniques of flying it and the facilities available to support it.

The following examples are taken from investigations of accidents in which tacan operation was a factor.

Case I

—"As the flight of three steadied on the CIC vector to a coastal air station, both wingmen commented to the leader that the flight was heading 30 to 40 degrees left of the vector."

Case II

—"The section turned left to a heading of 270 degrees and began tracking west to what they believed to be Blank AFB. The identification signal received was not Blank (BLK)." No attempt was made to resolve the wrong ID signal. Thus, as one other AAR reported, too often the tendency to ignore DR navigation as a check against the indications received from electronic navigation aids has resulted in disaster.

Tacan is an ultra high frequency (UHF) system, with all of the information received by the aircraft coming in on one frequency, containing bearing, identification and distance information. When the set is turned to RECEIVE it continually searches until it locks on a station. In this case, only bearing and an identifier are received, and the aircraft is electronically silent. By turning the switch to TRANSMIT/RECEIVE, a series of airborne interrogations are sent out which trigger a transmitter or transponder in the ground facility. Replies from the ground station are screened by the set with the correct ones being converted to operate the DME. A look at Fig. 1 may make this a little clearer.

Tips for Flying Tacan

Flying tacan is relatively easy since it displays both bearing and distance from the facility and has a course selector. Here are a few tips for making it even easier and more valuable.

A look at Fig. 2 will show that the signal is available for the limit of altitude compared to the radio horizon, but distance information is available only to the limits of the gear in the aircraft (195 miles). Present tacan sets are unusable at altitudes above 50,000 feet and have a shut-off feature to prevent arcing of the radio circuits and high voltage sections. Improved design of later sets will raise this ceiling to equal the ceiling of the aircraft. Some aircraft scheduled for this feature are the F4H and the A3J. (Naval Aviation Electronics Digest, NavWeps 08-1-503 Dec 60) Notice also there is a cone, sometimes called the cone of confusion (Figs. 2 & 3), wherein bearing information is not accurate, but where DME will operate. The following method will determine station passage:

When distance reading equals flight altitude and begins to increase.

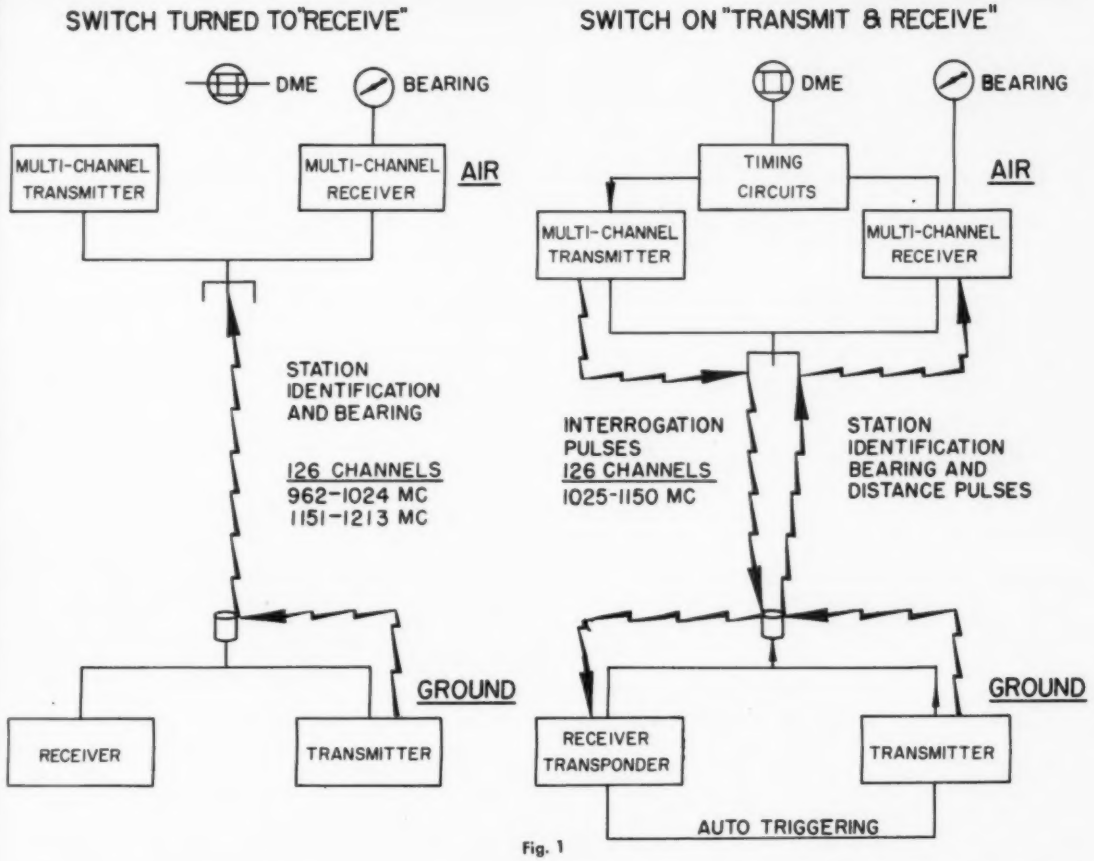


Fig. 1

Change in "To-From" indicator.

Course line indicator (vertical pointer) on ID-249 will make one or more full swings at station passage.

When the aircraft compass is malfunctioning, the magnetic bearing indicated by the needle on the RMI compass card is still usable. The relative station bearing will be in error. The course selector, course line indicator and distance information can still be used. When bearing information is inaccurate there is still the distance indicator.

Flying an Arc

Another maneuver that is possible with tacan and its distance measuring capability is the flying

Continued next page

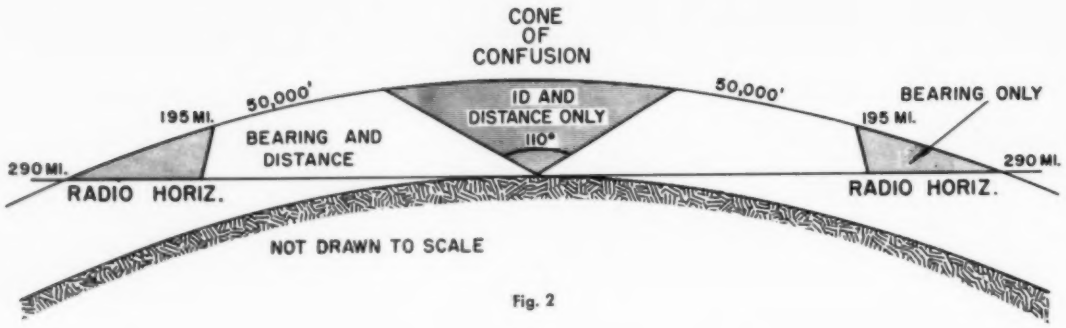


Fig. 2

of an arc around a facility. One way to do this is to put the station 10 degrees ahead of either beam position and fly until it is 10 degrees behind. The change in distance reading shows whether the aircraft is getting too close or too far away. Remember there will be travel through a certain amount of arc when making the turn into the station, so allow for this.

Movement of the course line indicator toward the center is the alert that the aircraft is within 10 degrees of selected course. Start the turn as necessary to end up on it. Coupled with this is a simple rule-of-thumb to use in figuring time around an arc. The rule is that 60 degrees of arc is the same distance as radius. Thus if traveling on the 20-mile arc through 90 degrees, it will take the same time as traveling 30 miles. To go through 120 degrees of arc the distance is twice the radius or 40 miles.

Approaches and Departures Utilizing an Arc

The arc created by maintaining a constant range is utilized for many approaches and a few departures. There are two points that should be considered, intercepting the arc and maintaining the arc. The interception most frequently is made from a radial. Anticipating the arc is required in all cases and the amount is determined solely by the speed of the aircraft. In a departure type arc, 25-30 NM with speeds of 300 kts or more, 3-5 miles is required to make the turn. On an approach type arc, 6-11 NM with aircraft speeds of 90-200 kts ½-2 miles will be sufficient.

In a no-wind condition the approach arc may be maintained within ½ NM by placing the tacan needle 1-2 degrees ahead of the wingtip. The departure type arc will best be flown by short "chord type" headings.

The transition from an arc to a radial can become a problem without first giving it a little thought. Range rather than speed is the determining factor for intercepting the radial. In an arcing approach, approximately 10 degrees is required to make the 90-degree turn while a tacan holding

COMPARISON OF CONES OF CONFUSION OF TACAN,
VOR AND LF AND CROSSING DISTANCES IN NAUTICAL MILES

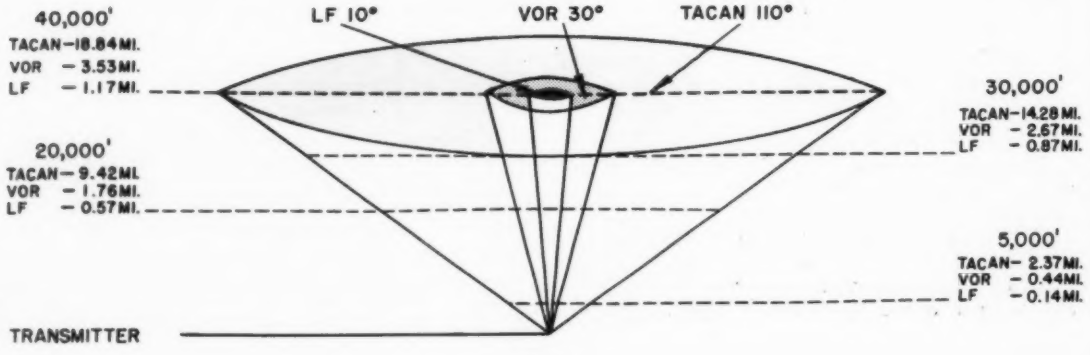
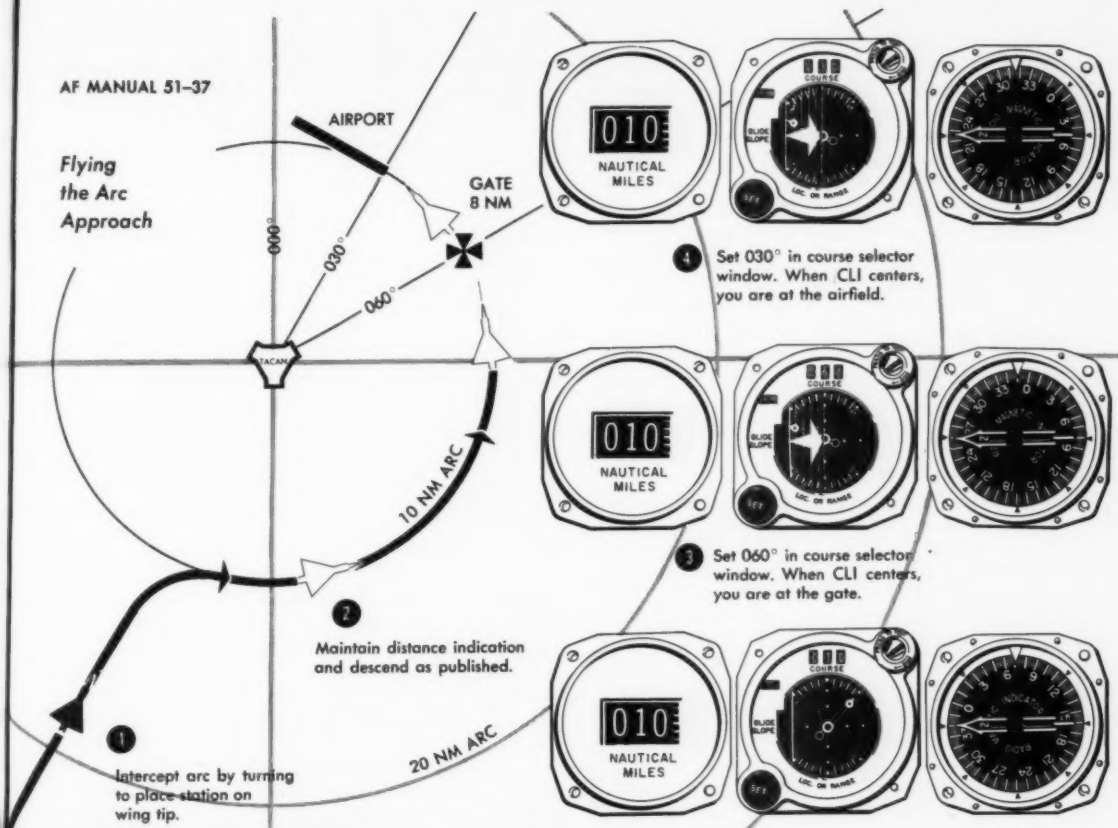
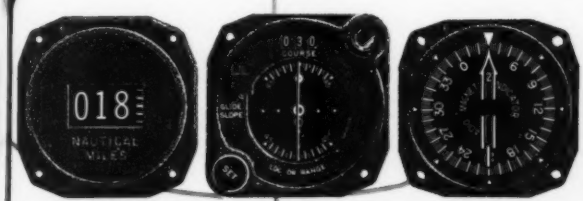


Fig. 3

Flying the Arc Approach


AIRPORT
GATE 8 NM
000°
030°
060°
TACAN
10 NM ARC
20 NM ARC
010
NAUTICAL MILES
COURSE
GLIDE SLOPE
LOC. OR RANGE
SET
4 Set 030° in course selector window. When CLI centers, you are at the airfield.
3 Set 060° in course selector window. When CLI centers, you are at the gate.
2 Maintain distance indication and descend as published.
1 Intercept arc by turning to place station on wing tip.



ID-310 (DME) ID-249 ID-250 (RMI)

pattern at 40 miles can be entirely contained in a 10-degree sector. Use of the ID-249 will facilitate this radial interception. From the point that the needle is off the peg to the center covers an arc of 10 degrees. On the arc approaching the desired radial with the desired course dialed in the course selector, note that the heading indicator approaches a 90-degree position from the desired track. Entering the 10-degree sector, increasing the turn to marry the heading indicator with the course line indicator creates a good rate of radial interception.

Tacan Errors

What can go wrong and how can errors be spotted? If the electrical compass system is in error the tacan needle will point to the correct magnetic bearing to the station, but will not indicate the relative bearing of the station. In other words the bearing needle in tacan is *not* a birddog, and does not function like the old ARN-6 low frequency receiver.

We know how to check the compass. How can we tell if the tacan needle is giving us a correct bearing? On the ground this is done by use of stationary check points on the air station. These are either in the form of small signs or markings, painted on taxiways and holding areas near the end of the runway, which give bearing and distance from that point to the tacan facility serving that airport. NavAer 00-100-505, Airfield Planning Standards, contains the Navy requirement for these markings, which also are found at USAF and some civilian fields. It is not necessary to be pointed in any particular direction to use this information. Just check to see that the tacan is giving you correct dope. Normally this difference should be less than 2 degrees. If it's over 4 degrees, IFR flight is not permissible according to CAR 43.

If one day this ramp check shows that the indicated bearing to the station is off 40 degrees, or perhaps multiples of 40 degrees, obviously the set is malfunctioning, so go back.

Though the reasons are rather technical, it is of interest to note that Naval Aviation Safety Center message 081940Z of April 1960 alerted the major commands to tacan receiver malfunctions caused by the following specific conditions:

- A tube failure in the electronic azimuth gate subassembly will cause a lock-on 40 degrees in error, probably less than the proper bearing.
- Improper adjustment of R-219 (potentiometer) in the video decoder subassembly may cause a lock-on 40 degrees in error in either direction.
- A malfunction in the ID-307 (azimuth indicator) can result in an error in multiples of 40 degrees in either direction.

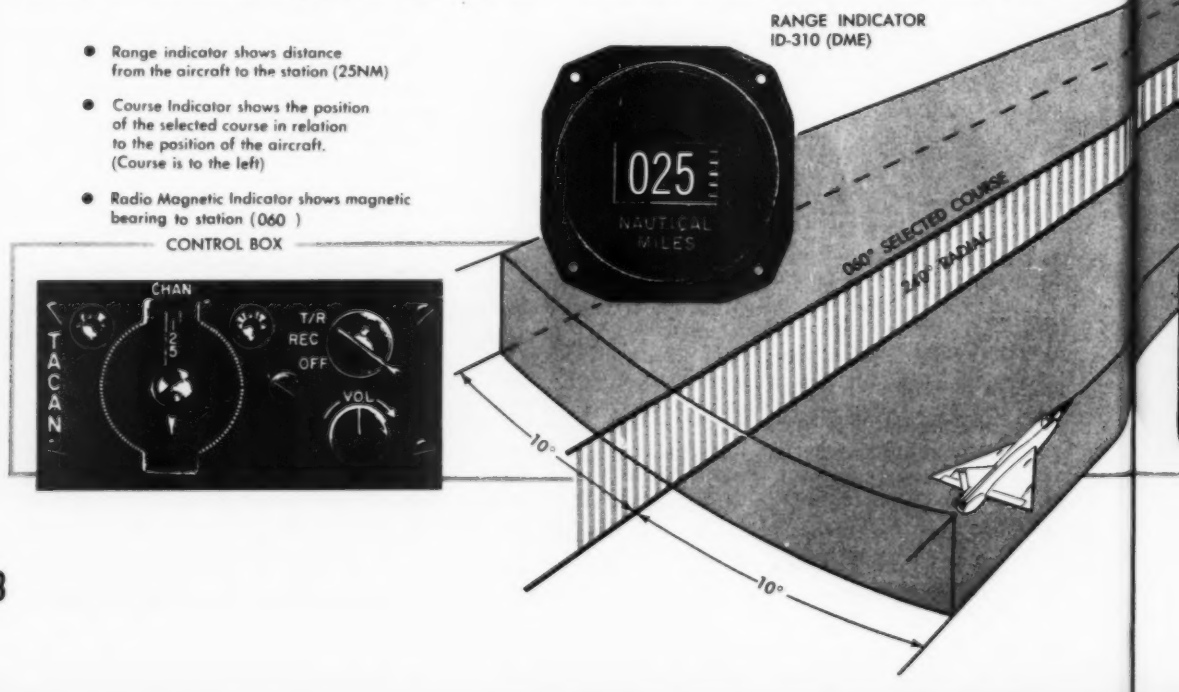
The course line indicator (ID-249) will also be in error in all such cases. In tacan-only aircraft you can detect this discrepancy only by observing a heading drift while homing. If you fail to note this and employ tracking technique utilizing the ID-249 to keep the needle centered a 40-degree crab would result, and you wouldn't go where you intended to.

What can be done about this while airborne? Having recognized this as a 40-degree error lock-on, the needle can be used for a steering reference if some other general heading reference is used. Since wind may be unknown and there is the possibility of the needle slipping into another 40-degree sector it could be dangerous to depend upon it as a true 40-degree error. In many cases, tacan distance information alone may be enough to get the flight to the facility for a Radar/GCA pickup.

Distance Indicator (DME) Approach

An approach can be made to a tacan station using the distance indicator only. It will not have the precision that could be obtained with use of bearing information but will be sufficiently close to allow GCA, ship's radar or ASR to take over. Sounds as if there should be nothing to this—just keep pointing in the direction that causes the distance to read less. But to avoid flying in a large circle and to conserve that always useful fuel try the following method.

Turn the aircraft so as to keep the range constant. When established on the arc make a course change of 30 degrees to either side. The change in range will indicate the general direction of the station in relation to the original course on the arc. This 30-degree change may be necessary if the distance is in excess of 100 NM because the arc is very close to a straight line. After making the 30-degree cut and determining the general direction of the station, re-establish the track on the arc. Once again maintaining a constant range, the station is now on the wingtip in the general direction previously determined. Turn to this heading and proceed for approximately one-half the existing range. At this point return to the arc and determine a new wingtip position of the station. Repeating the procedure until the range is 25-50 NM, and then proceeding along a wingtip



determined heading will place the aircraft within 2-4 miles of the station.

Maintain heading control and watch the ¼ mile marks on the distance indicator. In the meantime attempt to establish contact with GCA, ASR or the tower so they can make a radar pickup as soon as possible. It may help to draw a rough diagram on the kneeboard thus saving a wrong turn.

A word of caution—if there is even a partial loss of the primary navigation equipment, tell someone about it; ask for GCI/GCA or D/F steers; and resort to other available aids. Also, according to a recent change to CAR 60, when flying IFR within controlled airspace, any inflight malfunction of navigation or air/ground communications equipment must be reported to Air Traffic Control.

DME Errors

When will the DME be inaccurate? Fortunately this is a little bit more of a go-no go system. As long as the correct station identifier is heard and there is a display on the distance indicator, the correct slant range distance is being presented. If the transmitter is out there will be a bar across the dial. It is possible, although not probable, that the tacan station can be overloaded. There must be at least 100 aircraft tracking and simultaneously interrogating the same station in order for this to happen. It is also conceivable that 20 in "search" could momentarily overload the beacon until they start to lock on.

The DME has a memory circuit which stops the dials for a period of 10 seconds when the signal pulses are interrupted. This is a time-saving feature since it takes up to 30 seconds for the dials to make a complete circuit and lock on the correct distance.

Course Errors

The tacan needle gives a magnetic bearing to the facility. When the compass is out or is malfunctioning, relative bearing information is lost. Thus in order to track, the course line indicator and distance indicator must be used. The tacan needle will still point to the correct inbound bearing on the RMI. However, there is another way that a pilot can get into difficulty because of this feature. Suppose in going from one point to another a course is drawn between two tacan stations to find the correct bearings to fly. The course just misses a prohibited area but it can still lead to trouble! (See Letters pg. 3)

Tacan ground stations are surveyed-in to orient to magnetic north at their point of installation. Thus it is the difference in variation between the station and the aircraft position that must be considered. Let's take a look at a High Altitude Enroute Chart. In very faint lines you will find variation shown for each 4 degrees. Since the bearing readings are magnetic, variation will have an effect as will the sum of all the possible errors. The average error for each station is ¾ of a degree and the RMI to tacan needle error can be a degree or two. Add these and a 5- or 6-degree error results, which is enough to get that flight violation. Plan to dog leg around areas like this or eliminate the variation error in flight planning. It shouldn't be hard to miss them. The following example illustrates the above situation.

Using the J-24V between Flat Rock and Charleston as an example, note that the track outbound from FAK is 291°M while the inbound course to CRW is 286°M. If the FAK tacan could be used entirely along this route the pilot would have to track 291°M, despite his actual position. When

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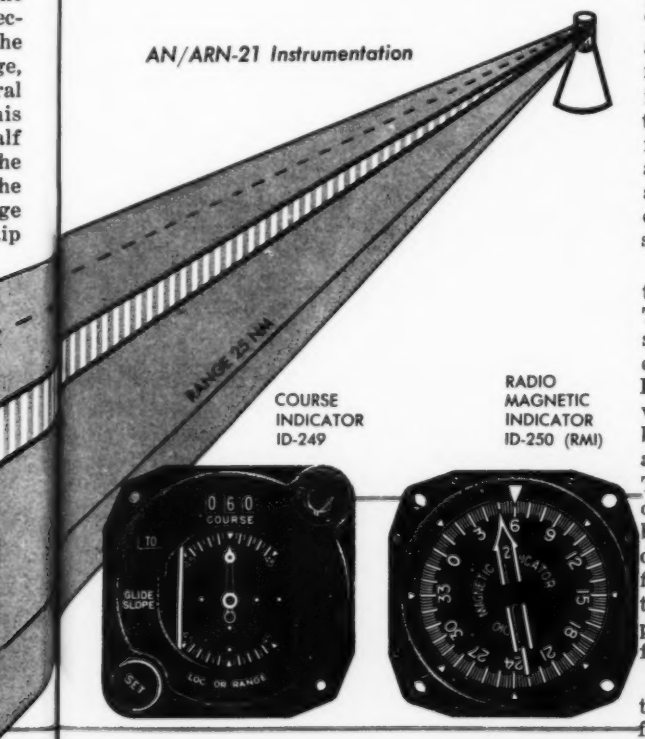


he changes to CRW and the tacan bearing indicates a 5-degree change in track he must know that he is now required to track 286°M and not attempt to correct for a non-existent error.

This problem is more prevalent along long direct legs when the change in variation is not so apparent.

Unlock Condition

A frequent headache to the tacan user is the unlock condition when the needle rotates counter clockwise and the bar may descend on the distance indicator leaving the pilot filled with rage and frustration. This unlock condition may be caused by anything that will interrupt the signal. A steep turn may shield the antenna; the condition of the atmosphere may cause part of the signal energy to be absorbed; in a rare case, another aircraft may blank out the set.

However if the unlock is caused by any of these temporary conditions, the set will normally lock-on again after one or two rotations of either the distance indicator or the bearing indicator. A memory circuit will hold bearing information for 3 seconds and distance information for about 10 seconds. If the flight has been tracked by all available means, unlock should not cause too much difficulty. The pilot can still use other navigational gear.

What about the bird that has tacan only? All aircraft presently equipped with tacan also have the ARA-25 UHF/ADF feature of the ARC-27 radio. The only drawback to the ARA-25 is the inability to transmit on UHF while using this feature, which sometimes requires a bit of fast shifting and a sixth sense to know when to be doing what. The A3D, F3H, F4D, F9F, F11F and T2J have or will have the ARR-40. At present the ARR-40, which permits simultaneous homing and radio communications, is set up for use with the UHF/ADF homers which are replacing the low frequency homers at Naval and Marine Corps Air Stations. Then there is usually GCI and UHF/ADF from towers.

Tacan Reception and Ground Equipment

The greater the flight altitude the greater the chance of good reception—obviously, but how much is enough? Fig. 2 shows the radio horizon as a straight line, and theoretically flying on this line should make it possible to receive a line of sight transmission. But theory and practice often differ —note Fig. 4 which shows the probability of reception. So in order to get almost certain reception beyond 80 miles it is necessary to be from 2 to 14 thousand feet above the radio horizon.

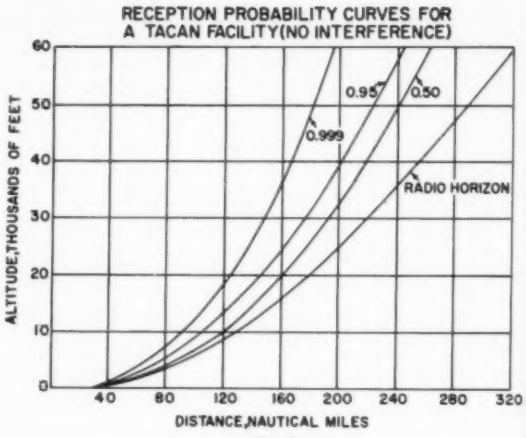


Fig. 4

When within 195 miles if no ID signal is received have the set checked. The ID signal circuit may be out of adjustment.

The ground support equipment required for tacan serves to highlight its unique advantages to the military. The Navy developed tacan originally for shipboard use, because VOR antennas simply could not be adapted for use afloat. On the other hand, tacan antennas, being in the UHF band, are quite small. Also, since tacan can be truck or trailer mounted, it is especially suited for use by the Marine Corps in connection with Short Expeditionary Landing Fields (SELF).

Station Designations (H), (M) and (L)

When tacan was originally conceived, the optimum separation was 450 nautical miles between stations. Due to the increase in numbers of facilities, without an increase in available channels, this separation had to be drastically lowered. To do this facilities have been divided into three classes — high altitude (H), medium altitude (M), and low altitude (L). These facilities are identified by the letters (H), (M) and (L) on FLIP charts and publications. *This designation does not indicate power output, frequency assignment or channel assignment of the facility.* For example, a low altitude facility may have a power output of 7500 watts using the AN/GRN-9 series, while a nearby high altitude facility uses the AN/URN-3 with a power output of 5000 watts.

The miles of separation between facilities and the miles of interference free service that can be expected according to the Enroute Supplement and OpNav Inst 3721.14 are:

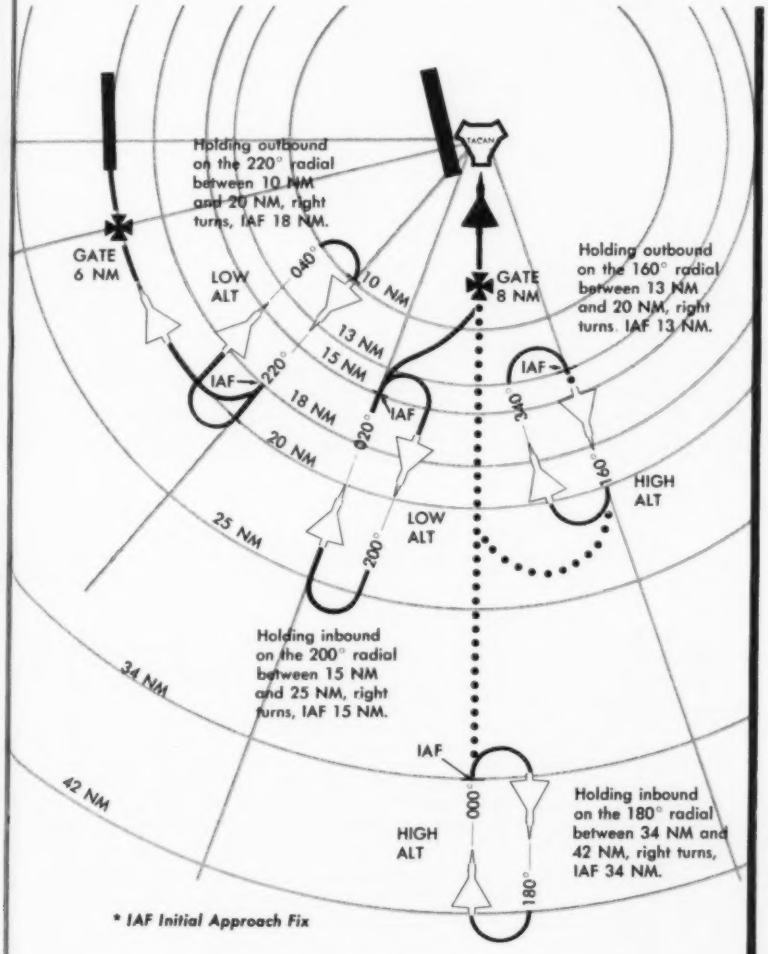
(H)	75,000′	Interference-free service	156 n.m.
		Closest cochannel station	450
(M)	30,000′	Interference-free service	78 n.m.
		Closest cochannel station	310
(L)	15,000′	Interference-free service	10-40 n.m.
		Closest cochannel station	200

Air traffic controllers may use "L" designated facilities for terminal control for the following distances at these altitudes: 30,000′, 30 n.m.; 25,000′, 25 n.m.; 30,000′, 20 n.m.

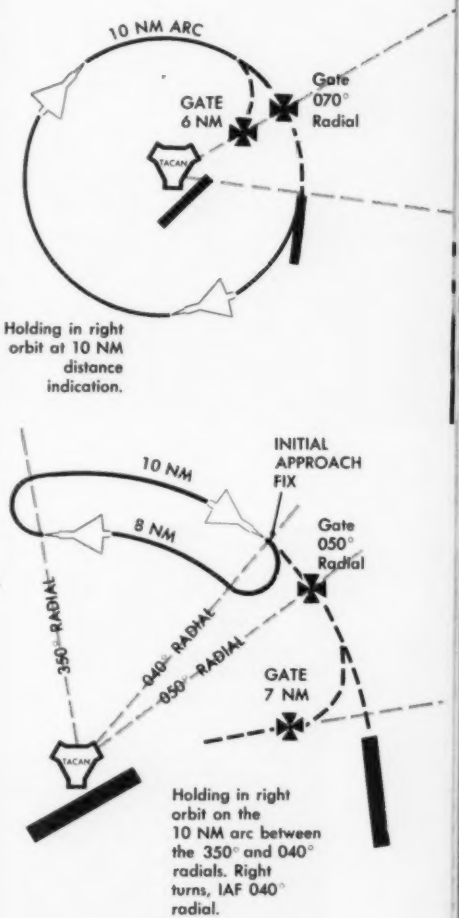
The above restrictions and designations are applicable to all VHF and UHF navigational aids, tacan, VOR and VORTAC. Therefore the facility designation is important in flight planning and use if interference is to be avoided. To keep from being misled, listen to the station identifier which comes through every 38 seconds. This is the best indication that the desired facility is being received!

Tacan Interference

What are the types of interference encountered while using tacan? They can be divided into cochannel interference, adjacent channel interference and interference from other sources. Cochannel interference is simply two facilities on the same channel. The only solution is separation of the ground transponders. This is complicated by the number of facilities in existence and their loca-


Holding outbound on the 220° radial between 10 NM and 20 NM, right turns, IAF 18 NM.
GATE 6 NM
LOW ALT
040°
220°
10 NM
13 NM
15 NM
18 NM
20 NM
25 NM
34 NM
42 NM
IAF
TACAN
GATE 8 NM
Holding outbound on the 160° radial between 13 NM and 20 NM, right turns. IAF 13 NM.
340°
160°
HIGH ALT
LOW ALT
200°
Holding inbound on the 200° radial between 15 NM and 25 NM, right turns, IAF 15 NM.
000°
180°
Holding inbound on the 180° radial between 34 NM and 42 NM, right turns, IAF 34 NM.
* IAF Initial Approach Fix

Holding on a Radial



Holding on an Arc

tion. Figure 4 gives not only the radio horizon, but also the probability of picking up a desired facility. Remember that all of these figures are approximations. Each facility may vary in some slight amount from the figures given. When in an area of equal signal strength of two facilities on the same channel, the azimuth indication becomes erratic and momentarily locks on odd bearings. Distance indications may be received from one or the other station unless the signal is interrupted. Fortunately this area of equal signal strength is narrow enough that it is transited fairly rapidly, and its indications on bearing and identification make the trouble obvious to the pilot.

Adjacent channel interference should soon disappear. It occurs when the effective bandwidth of two channels adjacent to each other are more than 1 megacycle wide, thereby overlapping and causing the same effects as cochannel interference. It will occur most often when you are tuned to a channel, say 44, but are quite close to a station of channel 45. The solution to this lies in the improvement program to upgrade the selectivity of all facilities to the equivalent of the AN/GRN-9 series transponder. New facilities are equipped to minimize this possibility and all older installations are being upgraded to prevent it.

Next comes the question of interference from outside sources. Tacan, being an electronic system, is subject to all the ills that can befall any other electronic device. It may be shielded by terrain, other aircraft, or atmospheric conditions may cause ducting. The difficulties of station siting have been mentioned.

Tacan eliminates many of these. But terrain, even though it does not block the line of sight, can affect the signal. A portion of the signal bounces off trees, buildings, metal bridges and bodies of water. This results in course roughness and may cause a momentary unlock condition. Proper siting and adjustments minimize these effects. Course roughness will not ordinarily cause erroneous information to be displayed in the aircraft.

The greatest potential source of interference to tacan is from IFF since both systems share the same frequency band. However by using good engineering and installation practices this type of interference has been reduced to an insignificant amount.

Tacan Stations and Channelization

Tacan service is of two types, i.e., military tacan at Naval Air Stations and Air Force Bases, and VORTAC facilities provided by the FAA. The VORTACs are the enroute facilities placed to serve the Federal Airways while the military tacans are primarily terminal facilities located at the field near the runway area.

What about numbers of stations in the USA? It wasn't too long ago that a cross-country flight in a tacan only bird was almost a pure VFR operation. It isn't so any more. The program is progressing rapidly. A large number of VOR stations exist within the USA. The FAA is converting these to VORTAC as quickly as funds and equipment become available.

Federal airways are now equipped with over 700 VOR (VHF Omni-directional) radio ranges, of which more than 300 are now equipped as VORTAC. Present plans call for over 500 VOR stations to be so equipped by 1963. In addition 126 military tacan stations are in operation in the Continental U. S.

Major S. E. Adams, USMC did the original research and writing for this long overdue tacan feature. Both APPROACH and Major Adams touched base during the writing and checking of the article with a number of interested activities and authorities, including instrument RAGs, FAETU, OPTEvFor, OP-534 and BuWeps.

Major Adams, a graduate of the University of Washington, who was designated a naval aviator in 1944, is just winding up a tour with FMFLant where he was an Operations and Electronics Warfare Officer. Shortly he'll be headed for the Orient with 1st Marine Air Wing. This will be his third visit to WestPac, having planted F4U wheel marks in the big conflict in the Okinawa campaign, and the Japanese occupation; in Korea, with the same F4U bureau numbers in a few instances, and then on to Kaneohe where he took F9F and FJ transition. Major Adams, a check pilot for many years, has a large number of jet pages in his logbooks. Prior to staff duty on FMFLant he took amphibious warfare training at Quantico and served as safety officer and instructor pilot for VMIT-20 at Cherry Point.

With over 1000 tacan and VORTAC facilities planned for the U.S.A. there is a very real problem of frequency allocation to prevent interference. The 126 available channels are allocated to users as follows:

Channel 1 through 16 for Navy ships.

17 through 59 civil and military use.

60 through 69 military, on a not-to-interfere-with IFF basis.

70 through 126 civil and military use.

All military tacan facilities are not shown on all charts. On the high altitude charts only those facilities frequency-protected by cochannel separation are shown; or if shown but not protected for high altitude, the facility is annotated with the available service volume, i.e., "M" or "L." Use of these stations beyond their designated range might result in receiving cochannel interference.

To make things a little easier in the cockpit there is now available a Terminal High Altitude book published monthly, covering the whole U.S.A. in one book. It contains only tacan, VORTAC and UHF/ADF letdown procedures. If this is the only equipment in the aircraft this book can save some bulk.

Remember that tacan is an electronic system subject to failures and errors as is any other black box system. But if failures are detected, or the errors compensated for, tacan will lead instead of mislead. ●

VORTAC - One more time

by John Jennings

IF YOU know all about VORTAC then read no further, but if you are not sure of your facts then it might be wise to continue. At a recent pilots meeting, attended by a group who represented a broad cross section of flying backgrounds, the subject of VORTAC came up. It soon became apparent that these pilots had a knowledge of VORTAC that was riddled with erroneous information but worse than this, their misconceptions had carried over into the fields of VORTAC's constituents namely VOR and tacan. A few of these misconceptions were: that a VOR station was nothing more than a VHF homer; that a tacan receiver was nothing more than a VOR receiver with "distance measuring circuits"; and a VORTAC station was a single transmitter combining the features of both VOR and tacan. With the increasing number of VORTAC stations and the ultimate goal of all FAA VOR sites to become VORTAC stations it behooves all pilots to get the right information.

In reality VORTAC is very simple. It is nothing more than a VOR (Very-high-frequency Omnidirectional Radio Range) station and a tacan (Tactical Air Navigation) station which operates simultaneously, the antennas of which are located at a common geographical position. When this much is absorbed then the problem breaks down to one's understanding of the similarities and differences of VOR and tacan.

The more prominent similarities of the two systems are found in that portion which is more familiar to the pilot, namely the components found in the cockpit. The two systems have identical features on the instrument panel and they are flown in the same way. The course deviation indicator, the TO-FROM indicator, the reliable signal warning flag, and the course selector are exactly alike and function the same in both systems. (All of these are incorporated in the ID-249.) The pilot will notice slight differences in the control boxes. Both control boxes have volume controls for use when identifying stations. In VOR operation this can also be used when receiving voice; the tacan system does not have voice capability. Another item common to both control boxes is the station selector. The tacan system utilizes a channelization system and the pilot merely selects the proper channel out of the 126 available. In the VOR system the actual frequency is used when tuning a station. In VOR boxes, frequency is selected by one of two methods, either a continuous tuning "coffee-grinder" type or by dialing in the frequency with frequency selector knobs.

Each of the respective control boxes contains a selector switch for controlling the mode of operation. The functions of these switches are entirely unrelated so far as the two systems are concerned. In the VOR system, this switch selects either the VOR or the LOCALIZER mode of operation. In the tacan system this switch has three positions: OFF; RECEIVE; and TRANSMIT/RECEIVE. In the RECEIVE position only azimuth information is supplied while in the TRANSMIT/RECEIVE position the pilot is supplied both azimuth and distance information.

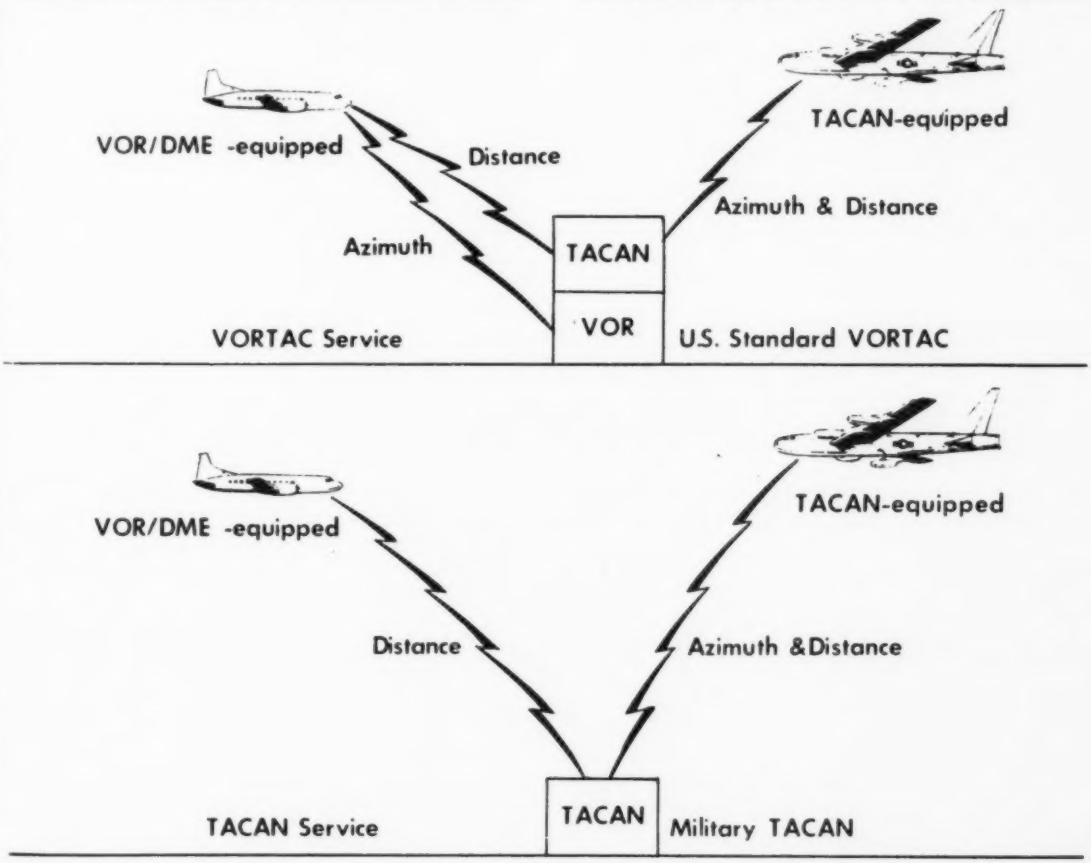
Another feature common to both systems is the needle which automatically indicates azimuth. This needle is similar to the needle found in the standard ADF set. However, in the standard ADF set the direction of the station is determined by means of a directional antenna which detects a null or no-signal position. In the VOR and tacan systems the direction to the station, as indicated by the needle, is the magnetic inbound bearing and is determined by electronic circuitry which computes this direction continuously.

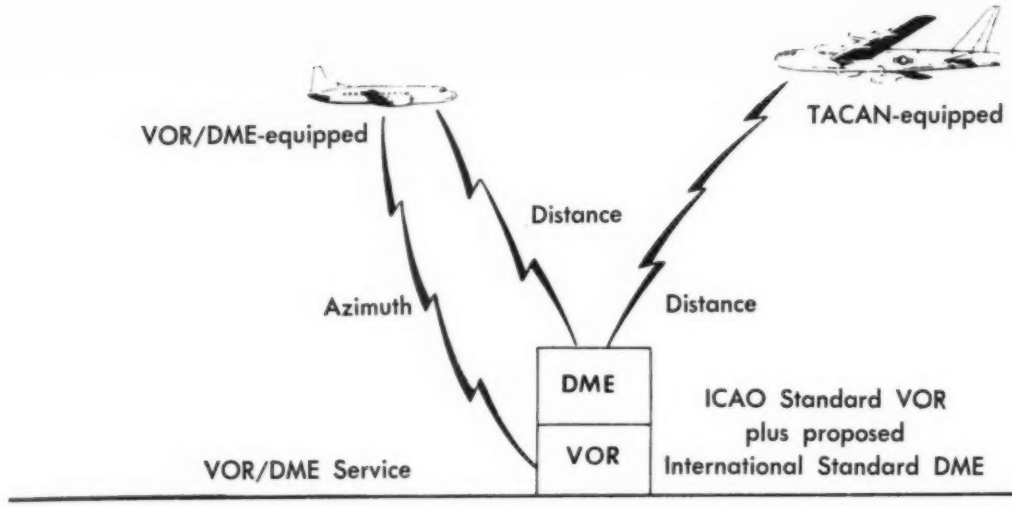
However, the real difference between the two systems is in the electronic method of operation. VOR operates in the VHF band of 108 to 118 megacycles and presents only azimuth information. VOR stations radiate signals which are modulated by two 30 cps (cycles-per-second) signals. One signal is constant in phase and independent of the aircraft's position, and the other varies in relative phase directly in accordance with the magnetic bearing of the aircraft from the station. The airborne equipment receives these signals, measures the phase difference and converts this measurement into a bearing which is displayed on the instrument panel. With this system, simultaneous voice operation does not interfere with the navigation signals.

Tacan is more complicated than VOR and this complication is intensified by the additional fea-

ture of providing distance information. Tacan operates in the UHF frequency range of 962 to 1213 megacycles. The tacan carrier wave is modulated by short pulses and the radiated energy is space modulated by means of rotating reflectors on the ground antenna. The rotating reflectors produce a 135 cps pattern which is superimposed on a 15 cps pattern. To supplement these audio patterns, coded pulse trains called reference bursts, are generated at specific points during each revolution of the antenna. The airborne receiver measures the phase difference between each audio pattern and its associated reference burst; in this way the coarse system determines the bearing to a few degrees which in turn is refined to the precise azimuth by a fine information signal. This method of using a coarse and a fine signal is similar to the action of a vernier; the result is an increase in accuracy in determining azimuth.

The distance measuring feature of tacan is integrated with the azimuth portion. When distance information is desired, the pilot turns his airborne equipment to the TRANSMIT/RECEIVE position and the airborne equipment begins to transmit pulses at a random rate. These pulses are received at the ground beacon and, in turn, cause the ground beacon to generate a reply pulse for every airborne pulse it receives. These reply pulses are mixed in with the azimuth modulation pulses and actually are a part of the azimuth modulation pattern. The airborne tacan receiver makes use of the random rate of its own interrogations to determine which pulses are the replies. The airborne unit can pick out its own reply pulses from the normal azimuth pulses. It also can discriminate from the reply pulses to other aircraft which might be interrogating the ground beacon at the same time. The interval from the instant the airborne equipment sends its interrogating pulse until the reply pulse is received is a function of distance. The airborne equipment measures this elapsed time and converts it into distance. This distance then is displayed on the aircraft instrument panel in digital form. Up to one hundred air-





craft may simultaneously and without mutual interference obtain distance service from one ground beacon.

As stated before, VORTAC is an individual tacan receiver/transmitter (transponder) and an individual VOR transmitter which operate simultaneously, the antennas of which are located at a common geographical position. The two equipments are usually housed in a single building and the coincident position of the antennas establishes a common navigational fix for two navigation systems. VORTAC is not an integration of the VOR and tacan systems but rather a coexistence of the two systems which enables aircraft equipped with different types of navigation receivers to navigate on the same airways. If one of the elements of a VORTAC station is disabled then aircraft equipped only with the corresponding receiver will be unable to navigate to the VORTAC fix while aircraft utilizing the remaining element will navigate normally.

One other aid to navigation, sometimes associated with VOR is NSME (Non Standard Measuring Equipment). This is an independent system formerly referred to as DME or "civil DME" which provides distance information only. This system is associated with VOR only to the extent that the NSME ground stations were coincident

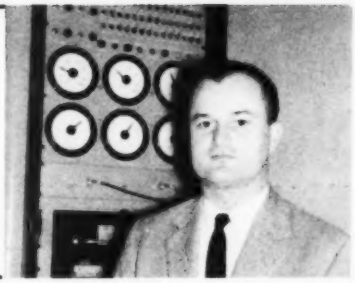
TACAN INCIDENTS VORTAC

MANY pilots fly for years without knowing the correct method of using their navigational equipment, or without knowing the difference between the various types of equipment available. Let's consider two near accidents that resulted from lack of knowledge of Tacan and Omni equipment.

A two-plane flight was inbound to a naval air station. During the process of letting down on an inbound bearing of 020° and while passing through 12,000 feet the flight broke out of the overcast. At this time, much to the horror of the flight leader they were heading straight into a mountainside of some 10,000 feet. Had the overcast been lower the flight would have hit the mountainside still letting down, and supposedly inbound 020° to the Air Station. The flight leader, convinced that the Omni was operating improperly, called for radar assistance and completed the approach to a successful landing.

During a Tacan approach the flight leader and his wingman switched to a GCA frequency and leveled at 4000 feet. Shortly after establishing contact with GCA, the wingman called station passage as the distance indicator (ID-310) started rotating. The flight leader reported a station passage to GCA. The GCA operator did not have the two aircraft on his scope but gave the aircraft a turn to 090°. After two minutes a turn to 180° was requested to bracket the aircraft downwind for a right-hand GCA. The GCA operator still was unable to pick the aircraft up on his

Mr. Jennings is an electronic engineer employed by The American Machine & Foundry Company. For the past year he has been on contract to the Federal Aviation Agency at The National Aviation Facility Experimental Center (NAFEC). While at NAFEC he has worked on low power DMET (Distance Measuring Equipment—tacan) interrogators. These interrogators will enable aircraft to use the distance feature of VORTAC and tacan stations. He is currently engaged in the AGACS evaluation program. AGACS is the Automatic/Ground/Air/Ground/Communication/System designed to relieve the congestion on present voice channels. He is a graduate of The Catholic University of America, class of 1953. His Navy experience consisted of a tour of duty with VS-39 where he was a Carrier Anti-Submarine Plane Commander. In addition he is a lieutenant in the 'Weekend Warrior' program and is presently attached to VA-661 at NARTU Anacostia.



with VOR stations. This combination produced a modified Rho-Theta system which enabled aircraft equipped with NSME receiver and a VOR receiver to obtain a fix. NSME stations operate in the same frequency band as tacan; *however, tacan receivers will not obtain distance information from these stations because of differences in the electronics.* For the same reason these NSME receivers will not obtain distance information from tacan ground beacons. (Although there are over 200 of these stations still in operation they are non-standard and are used primarily for flight inspection position fixing. These stations are listed in the FLIP Enroute-Supplement as NSME. Their occupancy in the 960-1215 MCS Band is on a not-to-interfere basis.)

For the pilot whose aircraft is equipped with VOR and who is wondering if he has to purchase a tacan receiver to get distance information, the answer is no. Currently available are DME receivers completely compatible with tacan that receive distance information only from a tacan ground beacon or the tacan portion of a VORTAC. These DME receivers will not be as expensive as complete tacan sets because they do not have any azimuth circuitry. With this DME receiver and a VOR receiver, the pilot will be able to obtain azimuth and distance information from VORTAC stations. These units are not integrated with VOR but are separate receivers that require tacan ground stations for their operation.

It should be clear that VOR is VOR, tacan is tacan, and VORTAC is a navigational aid marriage—a station consisting of a VOR transmitter and a tacan transponder whose antennas are located at a common geographical position. Aircraft equipped only with VOR will receive only VOR stations and the VOR portion of a VORTAC site. Similarly, aircraft equipped only with tacan will receive only tacan stations and the tacan portion of a VORTAC site. ●

scope. (He was searching in the area of the downwind leg). After establishing a 180° heading, the flight broke out into the clear just in time to make a hard right turn to miss a hill dead ahead sticking up into the overcast.

Why, in both cases, were these pilots very nearly killed and four valuable aircraft nearly destroyed? In the first case the flight leader, an experienced senior pilot, was convinced that the Omni station or his aircraft receiver were operating erroneously. In the second case the flight leader, though not so experienced was convinced that the GCA operator was incompetent.

It was proven however that in both cases the flight leaders did not know how to operate their equipment properly.

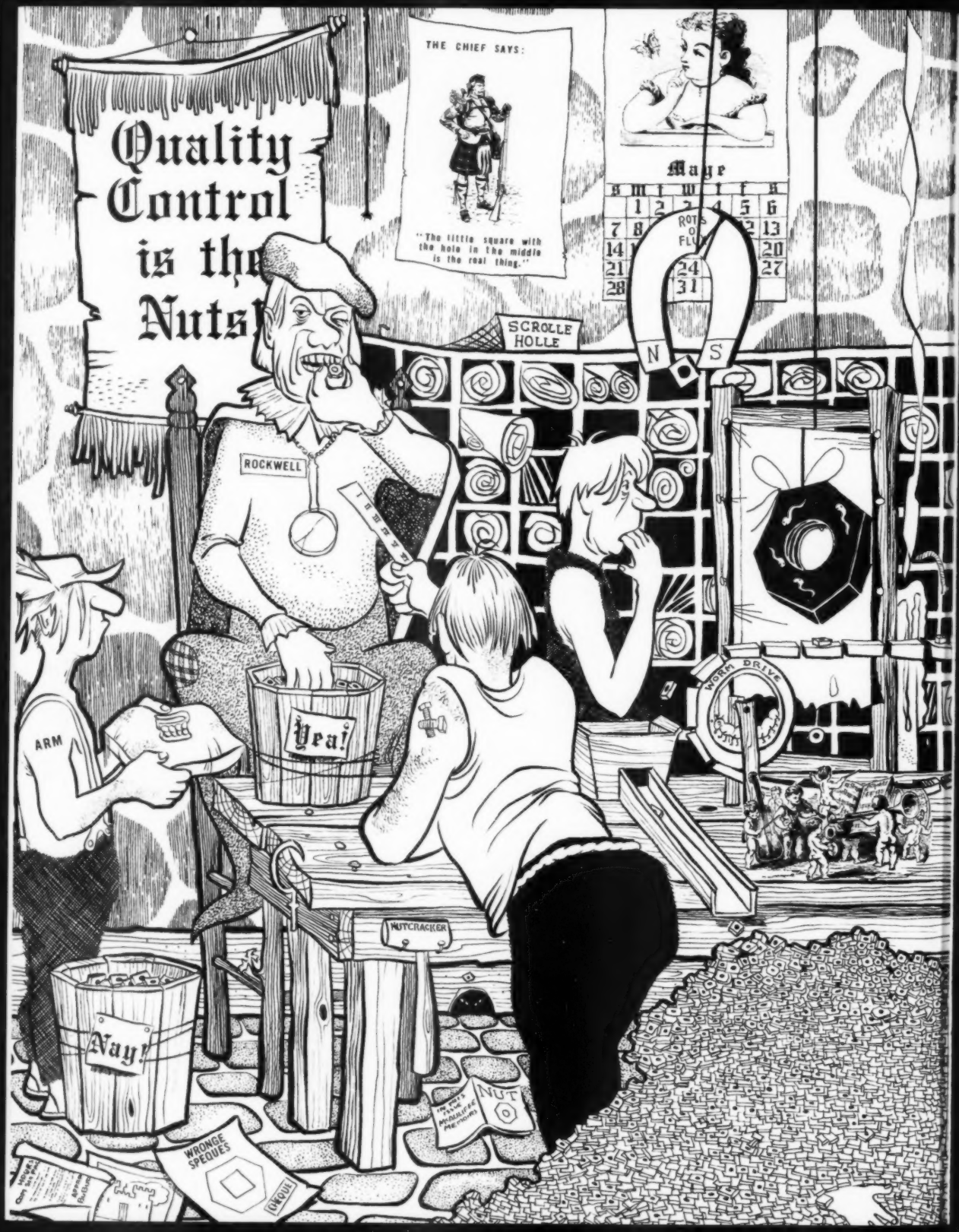
In the Radio Magnetic Indicator the needle in both systems (Omni or Tacan) points to the magnetic inbound bearing on the compass card; regardless of whether the compass card is dead, rotating or pointing to the magnetic heading of the aircraft.

In the first case, the RMI compass card was off approximately 40 degrees and the flight leader was using the no. 1 needle as a "bird dog" needle. The moral in this case is always use the course line indicator and set the desired course in the window of this instrument (ID-249). Using this method the RMI compass card can be completely inoperative and a safe penetration can still be executed.

In the second case the pilots had not passed the station as they had reported but in fact were still 10 to 12 miles out. The distance indicator should not be used as the only indication of station passage. Always use the course line indicator as the only true indication of station passage.

The RMI compass can become inoperative if one fuse blows. Don't bet your life on a fuse by using the Tacan/Omni needle as a "bird dog."

Understand your equipment and live. Installations vary with different aircraft, know them before you fly.—*The Sky Hook. Quantico* ●


Quality Control is the Nuts!
THE CHIEF SAYS:
"The little square with the hole in the middle is the real thing."
Maye
SCROLLE HOLLE
N
S
ROCKWELL
ARM
Yea!
Nay!
WORM DRIVE
NUTCRACKER
NUT
WRONGE SPEQUES

The Inspector and the Bolts

by Author Unknown but Revered

THERE dwelt in the City of Manch an Inspector of a Turbine Factory and his chief spoke unto him, saying "Lo, there is, in the wilderness of Traff, a maker of bolts, and he has made two score and five special bolts. They be Sooper-Dooper bolts and great is the tensile strength thereof, that they may fix the top of a cylinder casing even unto the bottom. Get thee hence and inspect them. And take micrometer and things, that thou shalt gauge them unto within the wideness of a certain part of a gnat. For I say unto thee, if thou shalt release them and they be found wanting then I will tear a strip off thee. Yea, if the bolts be not properly inspected, then will I cause a great misfortune to fall upon thee."

And the Inspector who was a sound bloke spake thus: "O.K. Chief, that which is asked for by Drawing and Specification shall be done."

And then he departed and journeyed unto the maker of the bolts who spake unto him saying: "Here they are Charlie. Want a sixinshrool?"

But the Inspector chided him saying: "Before I measure them command your servants and your handmaidens that they may deliver unto me all the paper works thereunto."

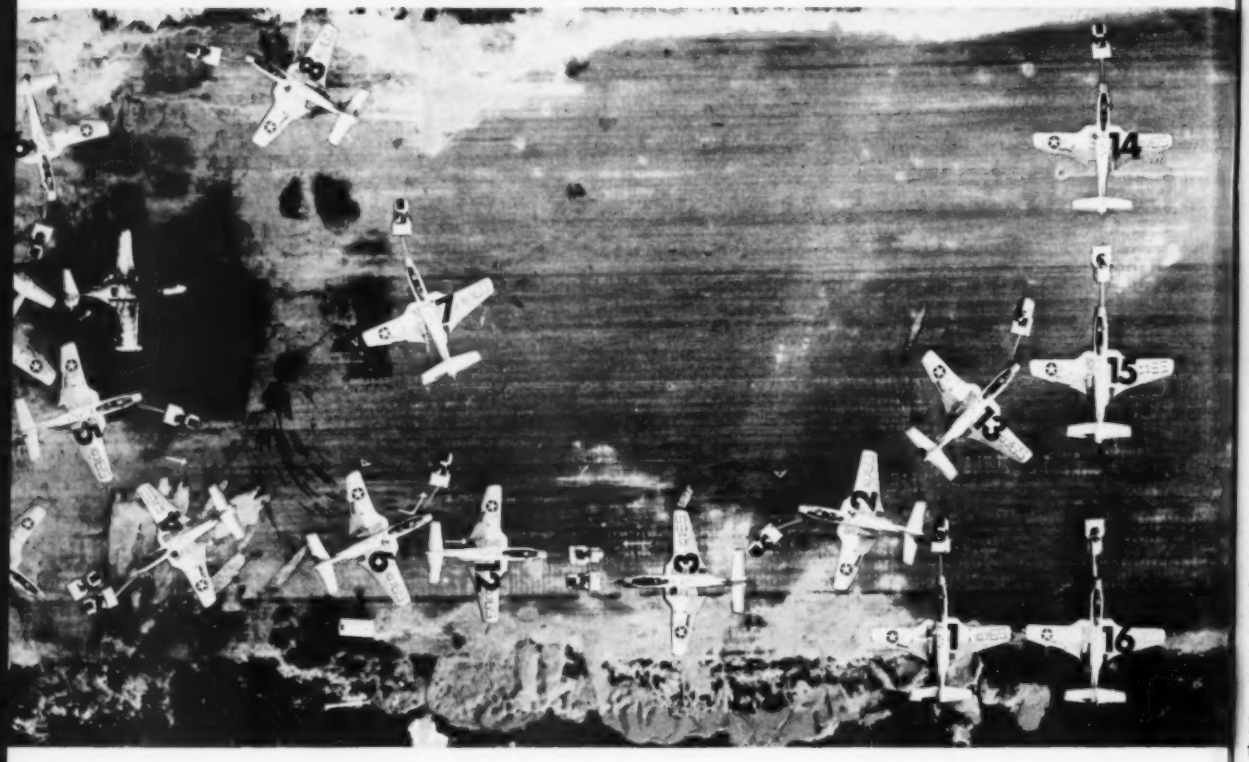
Then there were carried unto him one hundred and fifty nine scrolls, which were the Release Notes and the Test Certificates for the raw materials and the M.S.L. Certificate of the fiery furnace in which they did heat treat the bolts, and the Calibration Charts for the hardness machine in which they did test the bolts, and a host of Certificates of Accuracy for the tensile and Izod machines in which they did stretch and smite the test pieces. And there was also brought unto him a dog license, a copy of a Factories Act and a Pool's Coupon, which were included amongst the papers in error. And they delivered unto him also many M.S.L. Certificates relating unto the Wickman Gauges used upon the bolts. There were also Certificates of Chemical Analysis and Radiological Reports and Inspection Records and many other reports of strange and wonderful things of which no one knew the meaning. And they brought a copy of the order and set of drawings and a Pyrometer Record Chart which was fifty cubits in length and a multitude of other things too numerous to recite.

For twelve days the Inspector looked upon these things and on the twelfth day he said they were good. Then did he measure the bolts, and all the dimensions thereof were according to Hoyle. And he put them in strange positions and tested them upon a machine of Magnaflux. And he performed Rockwells upon them all, and some he rubbed with a precious jewel. Then he cast his eye upon them through a microscope, a horoscope, a telescope, a periscope, a stroboscope and other strange devices. And he did project the threads upon a screen and gazed upon their form and it was fair. And he gauged the threads by the law of Go and Nogo and the law of Root thickness. And from one bolt which seemed doubtful he did cause a test piece to be made, and great was the tensile thereof and Izod and the Elongation were fair to behold. Then he caused X-rays to shine upon them lest there be concealed weevils inside them. These things and many others which are in the Sacred Book did he perform with great cunning.

And when all these things had come to pass it was the evening of the nineteenth day and he made out a release note and inscribed therein all the necessary details. And he signed it and put his stamp upon it and upon the bolts also. Then he spake unto the bolt maker saying: "I do declare this batch of bolts to be pretty damn good. Dispatch them unto the Turbine Factory, and if they bounce, then I shall catch them without salt."

But Lo it came to pass, that they were rejected. They had been fashioned to an obsolete issue of the drawing. And the grief of the Inspector was terrible to behold.

—*Journal of the Society of Licensed Aircraft Engineers, Berkshire, England*

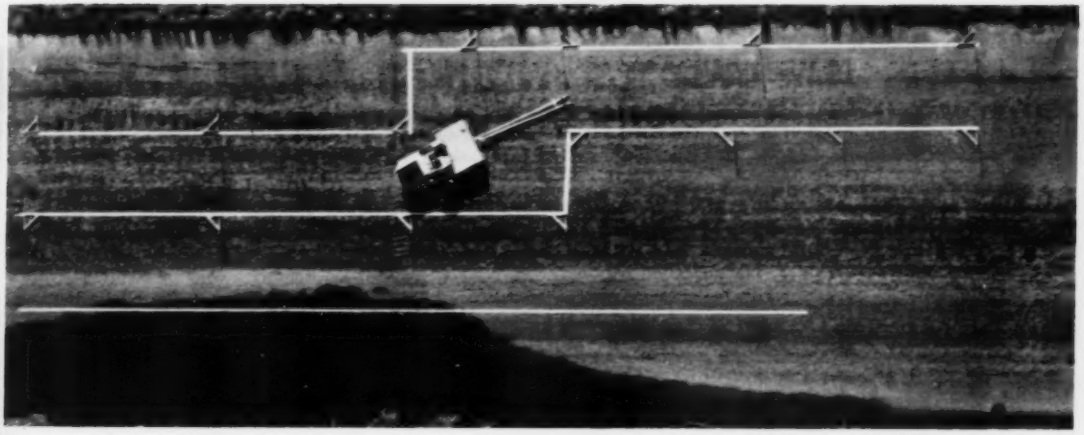


TOW TRACTOR COURSE

A MAJOR cause of concern in the Navy, the ground accidents involving towed aircraft, is being successfully tackled through a training program begun last June by the NAS Cecil Field Safety Division.

Since the inception of an Aircraft Tow Tractor Operator's Test Course, the rate of "crunches" has been markedly decreased at the air station.

Testing and training requirements are accomplished by utilizing a standard tow tractor, universal type tow-bar, and surplus F2Hs (entire operational test course is shown in photograph).



By following the aircraft in numerical order, the degree of critical wingtip clearance and maneuvering requirements can be easily observed.

All personnel at Cecil Field involved in aircraft towing operations are required to complete the course before being licensed. Included are reserve squadrons and other persons involved in this sort of work. Tests are supervised by Mr. James H. Stout, Government Motor Vehicle Operator for Cecil Field.

The course is understood to be the first of its kind in the Sixth Naval District. The idea of the test course is passed on to other naval aviation units.

Jacking Up The Radiator Cap

WHEN YOUR car or some household appliance acts strangely, performs poorly, quits or won't start, you personally know all the details.

Often you quickly determine for yourself what the trouble is, or if not, at least you have a good description of what happened to relate to others. If you take it to a professional repairman a typical question you may get is—"What did it act like?"—he's fishing for clues. You accurately and completely disclose all the little observed facts. The more you tell him the better the chances are that he can locate the trouble. When you tell him nothing except that it's his job to fix it—watch out—he'll jack up the radiator cap and "fix" everything from there to the trim strip on the tail fins and soak you accordingly. You asked for it — you didn't communicate helpful facts.

Your experiences with your personal mechanical problems and those of naval aviation are parallel. However, you have an advantage—you manage all phases of personal machinery troubles—you drive the car—you observe its deficiencies—you analyze and fix the trouble, or describe the trouble to a repairman and fight to keep the bill down by attempting to confine the work to the specific problem. But here is where the parallel parts—naval aviation is departmentalized and scattered all over the map—everyone is a specialist. Flight crews observe the trouble—maintenance people take corrective action—overhaul does the repair—supply compiles the cost and rightfully raises hell about the operating expense. In your case all communication was verbal, direct, complete and as accurate as your observation of the facts. But with the Navy—the communication job must be done by conveying the facts on several different paperwork forms. All the facts are not included and the people most interested in the history of the problem get only an implied—"it's your baby *you* fix it." So what can they do? They just start in by "jacking-up the radiator cap" disassembling the whole conglomeration and wind up by taking the rattle out of the tail fins.

Specifically we are thinking about parts returned to supply. When O&R "jacks up the radiator cap" to find out what is wrong with "inoperative" parts and equipment, the cost computers start whirring and the figures on the bill that spews out look like the mileage on a second-hand space vehicle.

Mystery about repairable components in your own shops are no less costly. You too often have to "jack-up the radiator cap."

Notations about the trouble on paperwork forms are vital links that hook up the train of events in parts and equipment management. We depend on the messages on these papers to convey the "what happened" to the repair organization so they can quickly get to the cause of the trouble and fix the unit with maximum efficiency.

Flight crew comments on the yellow sheets invariably contain valuable clues which can point to the seat of the mechanical difficulty. The better the job we do in preserving these observations through paper work notations the more we enlighten the gents in the shop. The high cost of all the major rotatable components certainly justifies all the history we can cram into the accompanying paperwork. Each extra minute or so spent to put down the background of facts may save a hundred or more dollars at the other end of the line. Also, put the poop on the Failure or Unsatisfactory Report (FUR).—*Adapted from AA Maint Ltr*

Unfamiliarity Breeds

FOLLOWING a layover at an East Coast air station the pilot of an A2F-1 noticed the canopy handle in a near-jettison position. As he touched the handle to reset it the canopy ejected damaging the fuselage and fin. It was determined that during the night the aircraft had been moved by personnel who were unfamiliar with the aircraft.

This accident lends emphasis to the point made by NAS Memphis (Letters APPROACH April '61) of the increasing tendency of transient pilots who expect line crewmen to perform all services on their aircraft such as preflighting and fueling without supervising this service. The varied models of modern aircraft virtually makes it impossible to qualify line crewmen for each model, particularly these currently being introduced to the fleet. It recommended that pilots stay with their aircraft until all servicing is completed and that pilots thoroughly preflight aircraft to flight. Don't let unfamiliarity become a factor in your accident.

A4D Elevator Jamming

IMMEDIATELY following catapult launch the pilot found his control stick jammed in a nose-up position. By jettisoning external fuel tanks and use of emergency trim the pilot was able to get the aircraft back aboard. The elevator power cylinder hook was found driven back under the elevator power boost hook drive pin jamming elevator movement. This condition is possible when elevator power boost control is partially disconnected and the combination of back stick and the force of catapult shot caused the hook to be driven back under pin. This is the second recent occurrence. It is suspected this may be the cause factor in some of the "cause undetermined" off-the-bow accidents.

There is no way for a pilot to positively determine whether elevator power boost control is partially or fully connected. A fully disconnected system can be detected but poses no danger of elevator jam. Because of the ease in which the power system can be unknowingly partially disconnected by a person working in the after engine compartment and resultant danger to the pilot and aircraft it is imperative that operators:

► Insure that power controls are connected in strict accordance with the HMI.

► Point out the danger of inadvertent partial disconnection of elevator power boost system during maintenance in the after engine compartment.

For Want of a Nail

ACCIDENTS are usually caused by a series of events, each parlaying until the grand payoff takes place. Sometimes a chain reaction takes place that spreads far beyond the original failure and may involve other aircraft as well.

One classic example that happened a few years ago will illustrate this point. A mech in a transport squadron forgot to put washers under the nuts that held the prop governor cover down. He tightened the nuts down as far as they could go, but the threads on the studs didn't go all the way to the bottom and the cover was still loose.

The inspector and crew chief didn't catch the discrepancy. Shortly after becoming airborne with a load of high priority cargo the pilot noticed oil pouring out from the prop governor and landed at a civilian field and requested a replacement aircraft from home base. The replacement crew brought mechanics, seals, oil, etc., and started to fix the prop governor. Repairs were completed late in the day and everyone was anxious to get home and rushed a little too much.

The engines were started without the usual procedure of cranking them through before switching the mags ON. Result—a hydraulic lock in the lower cylinders of the other engine. This was discovered during the takeoff roll when the entire oil supply was pumped out on the runway. With much screeching of brakes and tires the bird was stopped a few feet before running out of runway. Now an engine change was required. The new engine, along with a crane, work stands,

special tools, sentries, mechs . . ., had to be shipped by road. This required 11 vehicles and, due to low railroad underpasses they had to be routed through the next state.

If you think this is the end of the story, brother, read on. During the course of the engine change it was discovered that more parts were needed and they were flown in by another aircraft. Upon take-off the crew of this bird forgot to remove the elevator battens and it ended up off the end of the runway and down an embankment as a complete strike.

The last phase of the comedy of errors resulted when another transport, bringing in more supplies, lost an engine and this required another engine change.

This added up to one strike, two engine changes, TAD for 25 men for over one month and considerable loss of face to the service.

Now I'm sure nobody would blame the poor mech for all this fiasco, but the fact remains that he lit the fuze that started the whole chain reaction and had plenty of help along the way.

Don't Be A Chain Reaction Igniter—2nd MAW

So Write!

TO THE BEST of our knowledge no one ever accused the aviation mechanic of being unwilling to express an opinion. Opinions have never been in short supply in hangar, shop or locker room, and mechanics as a group, are not hesitant in voicing their views. It has even been said that we talk too much!

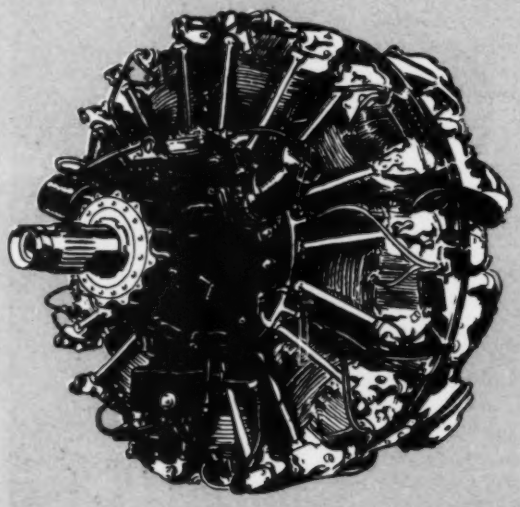
But we are prone to write too little! That's bad!

Take the mechanic who fails to write up the repair he has made or the part he has changed. He not only makes unnecessary work for others, but he fouls up records that are vital.

Consider the mechanic who never does anything about his ideas. Many, many mechanics have seen how an aircraft component could be redesigned to make it safer, more reliable, more accessible, easier to repair. But only a few have ever dropped a note to Engineering about their discovery. And so all of us continue to get the old design that is not safe, that is harder to reach and more difficult to fix.

Continued

R3350 Operators, Please Note!



BuWeps has outlined a program to reduce R3350 engine piston and ring failure.

In order to determine the effectiveness of this program request all activities be required to submit urgent AmpFURs on all piston and/or piston ring problems and that AmpFUR contain the following:

- ► Detailed description of trouble encountered.
- ► Cylinder location.
- ► Whether or not piston was new or used.
- ► Date of last overhaul.
- ► Overhaul activity.

All engines produced by O&Rs after 1 July 1960 should have all provisions of reference letter incorporated. Therefore, particular attention should be given to failures which occur on engines and/or cylinders overhauled after this date. Operating activities are encouraged to release parts overhauled after this date to the local Wright Air Division representative for contractor's investigation when failure occurs. *BuWeps Instruction 13070.1 refers.*

There probably isn't a mechanic with more than two years in the business who hasn't invented a tool or a procedure or a gizmo that makes maintenance quicker and easier. But how many have ever written about it to APPROACH? Not many. This can't be a reluctance to share. It is just an unwillingness to write.

An informal note—an Anymouse Report will do—this kind of writing requires neither literary skill nor the services of a secretary. It does require initiative and a professional approach to maintenance. The good aviation mechanic has both.

So make with the pencil, on both sides of the paper, please!

Oxygen Line Confusion

REPORTS of three instances of interchanged oxygen lines following PAR of F8U aircraft indicate similarity of appearance of the lines as the underlying cause.

In each case the flexible supply line was interchanged with the flexible vent and buildup line at the pressure opening and closing valve. The similarity of the flexible lines makes it difficult to properly identify as to function and correct connection points on converter components.

BuWeps has requested the contractor to investigate and submit recommendations for corrective action to prevent the possibility of interchanging lines in both service and production aircraft. In the meantime—don't be trapped—refer to the HMI.—BuWeps Msg. 161732Z Jan '61.

Don't Keep It a Secret

AFTER two minutes of flight at 600 feet the pilot of an A4D experienced a compressor stall. He retarded the throttle and the stall became more severe. Upon reaching 3000 feet the pilot ejected and the aircraft crashed into the sea.

The cause of engine failure was undetermined but investigation showed the engine had a history of high oil consumption. In fact, 11 quarts were added after the previous flight but fact had not been reported by the plane captain.

Proper oil system servicing requires the following essentials:

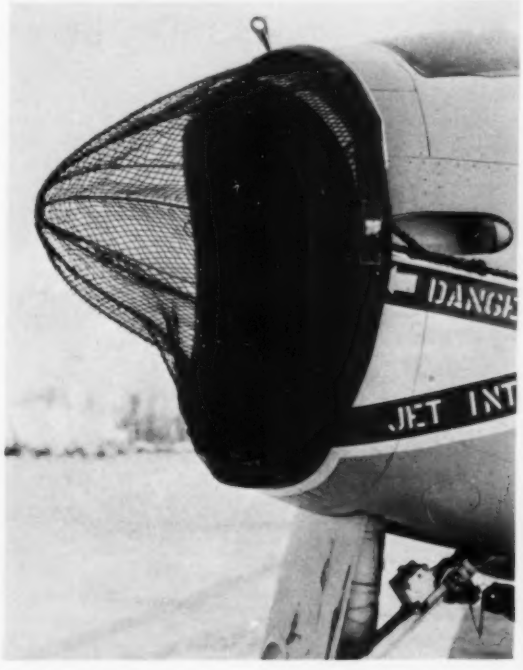
- ► Service with clean oil
- ► Use clean service equipment
- ► Service after each flight
- ► Record and compute oil consumption

If consumption has averaged, for example, one pint per hour for a number of flights and suddenly requires substantially more than the average amount of oil, be wary—report it. Troubleshooting at this point might prevent an engine seizure and an accident.

Ice Collapsed Intake Screen

THE weather was foggy, with a temperature of 35.4° F. and a barometric pressure of 30.30. The engine was running at 100%. It was 0800 on 13 January 1961 when two men attached to VU-4 at NAS Oceana were holding a routine high-power turn-up. A phenomenon occurred which could have been a tragedy.

Suddenly the safety man noticed ice had formed on the intake screen and air entering the intake had caused it to collapse. When he saw this he promptly gave the "cut" signal, but not in time to stop the screen from being pulled into the intake. Fortunately, nothing was damaged but the screen. If, however, the screen had damaged the engine it would have required an engine change,



loss of the entire FJ aircraft or possibly a loss of life.

When turning up aircraft it is necessary to take into consideration the weather, temperature, pressure, etc. A close study of the reasons for this occurrence should be made by every man who is related in any way with aircraft turn-up.

Elbow Room

WHILE moving an HSS-1 from its spotted position next to the port hangar deck bulkhead a tractor and tow bar were attached to the front of the aircraft, brakes released and tail wheel unlocked as directed by the aircraft director. After the tractor had moved five feet forward and slightly starboard it was discovered that the tail wheel locking pin had not released and the tractor was stopped. The action of stopping the aircraft released the tail locking pin. When forward movement was resumed the tail of the aircraft swung to the left with the horizontal stabilizer contacting frame 112 causing the following damage: Bent and tore the forward end, starboard side of the horizontal stabilizer. Two bushings were loosened in the port hinge assembly.

Comments and recommendations of the Board

Failure to check the release of the tail wheel locking pin was the major error committed in this accident. During the initial move of five feet the helicopter maintained practically a straight path, due to the locking pin not releasing, whereas the tractor moved to the right. Once the tail wheel locking pin was released, the off center position of the tractor caused the tail of the helicoper to swing to the left with such speed, that the director was unable to take corrective action before contact was made with the side of the ship.

Towing of the HSS helicopter at close quarters on the hangar deck, especially from the front, is not a recommended procedure. The slack and angle at which the tow bars are attached to the aircraft can cause or allow the tail of the helicopter to swing to either side until aircraft and tractor are in line.

Recommendations:

That the position of the tail wheel locking pin be positively established before all initial moves.

That ComNavAirLant Inst 3700.5B be adhered to at all times, specifically that part which states: "Utmost caution must be exercised when bow towing. Tail towing is mandatory in close quarter maneuvers where sharp turns are necessary."

Foreign Objects in Fuel Tanks

THE STARBOARD internal fuel cell of an F4D was being removed due to a fuel lock. After removal, the fuel cell was being inspected and a metal bar (see photo below) was discovered inside the sump compartment of the fuel cell. It is highly probable that the foreign object found in the fuel cell was accidentally or inadvertently left in the fuel cell by personnel that replaced the cell during PAR 94.9 hours previously.

It can not definitely be established that the foreign object caused the fuel leak; however, any foreign objects found in fuel cells should be considered hazardous, particularly with carrier based aircraft that are subject to arrested landings and catapults.

Coincidentally, an aircraft manufacturer was fined by FAA for debris discovered inside fuel tanks. Quality control measures imposed by the manufacturer following this experience are considered noteworthy. These include:

► Restricting the number of people having access to tanks.

► Training special mechanics to service internal wing areas.

► Keeping an inventory of all tools and articles carried into the wing of each aircraft.

Lint Fouls Fuel Control

UPON disassembly and inspection of a fuel control and carburetor red lint from a standard commerical red wiping rag was believed to be responsible for reported loss of power or lean carburetor/fuel control.

ComNavAirPac directed the following action be taken to *prevent rags from being used for the following purpose:*

- to clean side of fuel tanks
- to clean fuel strainers and associated parts
- to plug fuel vents, fuel lines and fuel strainer cavities or other openings when performing routine replacement or maintenance.

BuWeps was also requested to provide positive instructions for cleaning tanks.—*ComNavAirPac msg 260221/10 Jan 1960*

MURPHY'S LAW*

New Specs for Airspeed Static Tube Markings

AS REPORTED in the August 1960 issue of APPROACH, seven naval aircraft within a fifteen month period were involved in accidents with varying degrees of damage. These accidents were the result of aborted takeoffs after improper airspeed indication was noted.

In all these cases, improper airspeed indication was caused by cross-connection of pitot and static lines and subsequent failure of maintenance personnel to perform the functional check for the pitot static system.

Although the mechanics erred grossly in neglecting to functionally check the system when the lines were reconnected, it is felt that the design of the equipment was not entirely without fault. Present day airspeed indicators have two identical 7/16-20 threaded connections which have been an aid to Murphy's Law.* Another aid to Murphy's Law grew out of the situation that the mechanics had only one coding (AND 10375) for both the pitot and static lines as a guide in reconnecting system tubing.

The Bureau of Naval Weapons, in order to provide a positive identification of lines and eliminate cross-connection of pitot and static pressure lines has taken action to amend Pitot and Static

* If an aircraft part can be installed incorrectly, someone will install it that way!

Fig. 1

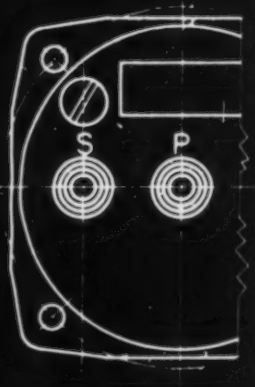
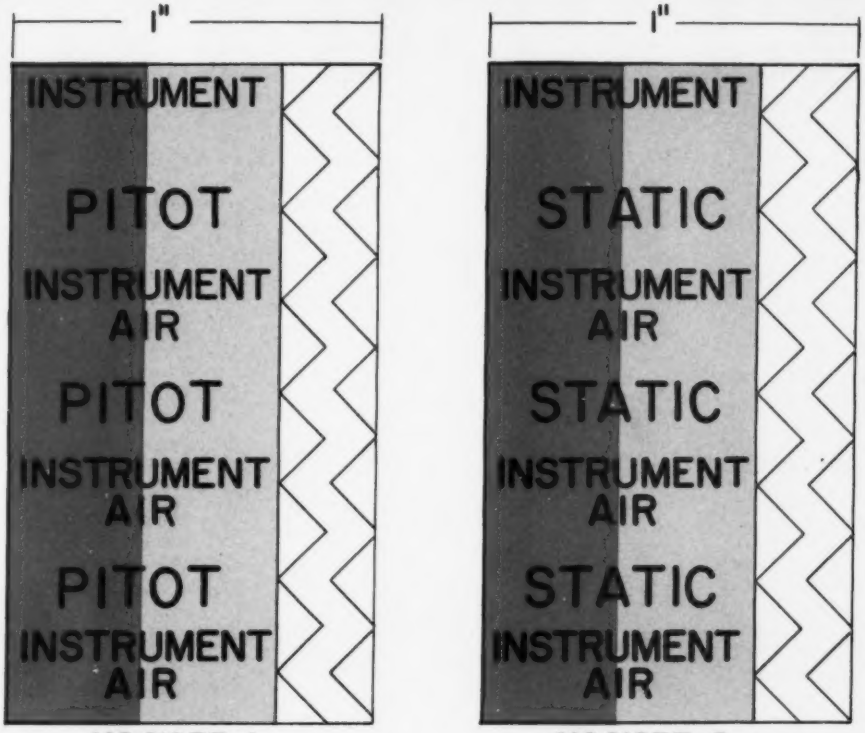


Fig. 2

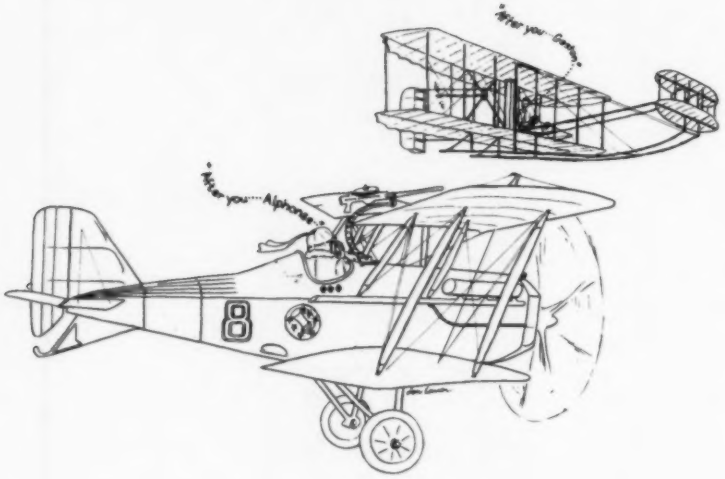


Reproduction of this amendment to Specification AND 10375 will be made on Kling Stick paper for the purpose of up-dating NASC color code poster B26-G1-860. Distribution of these will be made with Crossfeed 3-61. Recipients are requested to attach same to posters now at hand.

Installation Specifications MIL-I-6115 and MIL-I-5072 to require color coding to distinctly specify which is pitot and which line is static. This not being enough the bureau amended Naval Airspeed Indicator Specifications and Standards to require indicator case markings be changed from Figure 1 to as shown in Figure 2. However, procurement of indicators in accordance with Figure 2 will be made for new aircraft and replacement parts, thus it will be some time before all aircraft can be equipped with the latest design. As an interim measure the bureau has issued Standard MS21977 for the marking of the pitot-static lines (see Figure 3) and Aircraft Instrument Bulletin No. 5-60. The AIB requires that tapes in accordance with Standard MS21977 be placed within three inches of the terminal ends of all pitot-static fittings.

Knowing the above action cannot be considered fool-proof, the Bureau of Naval Weapons is conducting a study to determine the feasibility of using fittings with non-interchangeable characteristics in hopes of solving our cross-connecting problem once and for all. ●

CLIPBOARD



Courtesy

I AM, of course, interested in getting improved control by towers but I feel that there are many situations throughout the whole aviation industry that could be improved by the use of good, common everyday courtesy by the pilots.

As for the controllers in the towers across the country, this group of people probably get as little credit for doing a good job as any group in the industry. It is often very difficult for the human eye to judge the distance of two or more airplanes in relation to each other, especially when they are of varying sizes. This often results in the controller clearing one airplane to land ahead of another that should properly be first in the landing sequence. This is where the pilots can and should be courteous and cooperative with each other.

I find many pilots try to avoid or at least "soft pedal" this subject. Perhaps they do not want to admit that they are not always as courteous as they should be in this respect. I expect that we are all guilty of taking advantage of the controller's occasional (sometimes frequent) misjudgment of who should be cleared ahead of whom in the landing sequence, very often gleefully. To deny that this exists is to bury our heads in the sand.

There are several factors that should determine the priority of aircraft in the landing sequence, the most important of which is SAFETY, and the least important should be the shallow pride gained from beating someone else to getting on the ground.

I am sure that all the members of ALPA are interested in having good, efficient control of air traffic and one way that each pilot can contribute to better control and safer, less confused traffic is to be more courteous and cooperative with each other and with the traffic controllers. I would like to see a movement throughout the whole Association toward this goal. After all, we consider ourselves professional people in the same sense as doctors and lawyers, and rightfully so. To deserve this distinction, we must exhibit good manners and be "big" enough to say, "He's ahead of me, Tower, we will follow him." And, incidentally, saying, "Thanks" to the pilot who gives way is also an important part of good manners.

Let's leave the competing to the traffic and sales departments of the airlines and have more courtesy and cooperation among the pilot groups in all aspects of our work. This is becoming more and more imperative with the expanding operations of jet aircraft.—*ALPA "Tech Talk"*

Answers to Whiz Quiz

Page 21

1. True. The thing to do is protect yourself against it before it happens.
2. True
3. False. They block out high frequency noise better than low frequency noise.
4. Ear protective devices *do not* interfere. Speech of a given intensity can be perceived more clearly through ear protective devices than without them.
5. Industrial hygienists recommend that ear plugs in daily use should be washed daily with soap and water.

For more info on noise, see page 26

Fuel Handling Operations

These operations are a service function and are extremely important to the attainment of the mission of the Naval Air activities.

The principal objectives of fuel handling personnel are:

- ▶ deliver the correct fuel in a clean and uncontaminated state to the aircraft,
- ▶ deliver the fuel to the aircraft safely and efficiently, and
- ▶ operate and handle the equipment correctly and carefully to prolong equipment life and to reduce maintenance.

When these objectives have been reached there will be no accidents or fires in the air or on the ground due to poor fuel handling.

—NavAer 06-5-502

This is the 50th anniversary year of U. S. Naval Aviation. And this is the 50th anniversary month. On 8 May 1911 the first naval aircraft was purchased. The first Navy bird was a Curtiss two-place biplane, called the TRIAD and designated A-1, and proudly carried a 50-horsepower pusher, water-cooled engine. It had side by side dual controls and was used as a trainer. The under-carriage made it amphibious — floats and a tricycle landing gear. That's right — tricycle gear is older than three-point, at least in the Navy!

But things do change and the safety problems today are a little different. Some old and some new appear in this issue.

Remember How Much Fun Flying Used To Be . . . . . Page 4

A little nostalgia — a little education

Earosion . . . . . Page 6

Noise is still with us — there's just more of it

Tacan . . . . . Page 24

The straight word on techniques for using tacan and on the problems that can be encountered